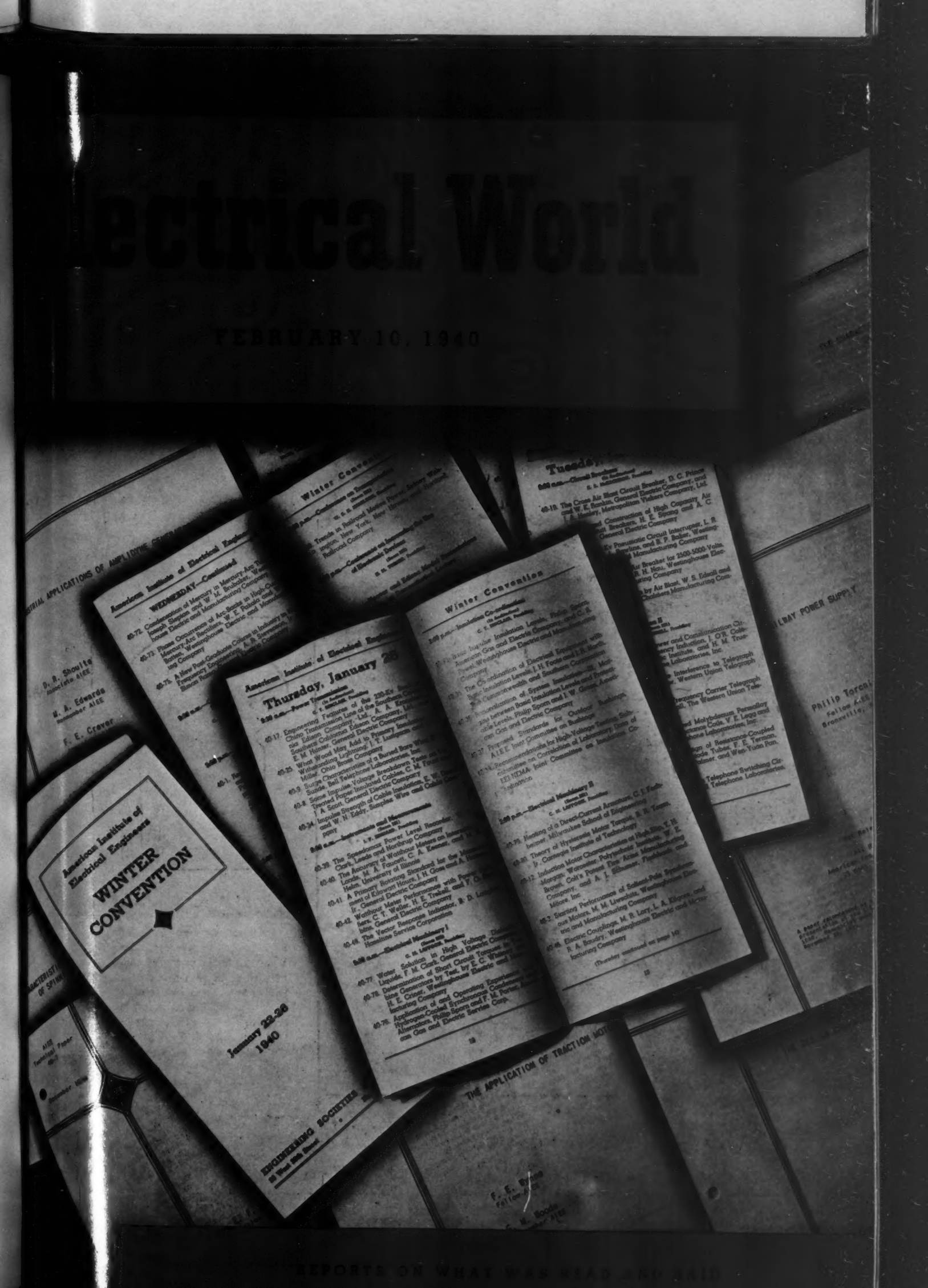
Electrical World
FEBRUARY 10, 1940
American Institute of Electrical Engineers
WINTER CONVENTION
January 22-26
1940
ENGINEERING SOCIETIES
Winter Convention
Thursday, January 25
THE APPLICATION OF TRACTION MOT

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One Way to End Unemployment

Two highly significant documents came out of Miami last week, where the American Federation of Labor has been holding its mid-winter meeting. The Federation Council went on record as asking the Administration to give business a breathing spell in order to restore employment. Later ten labor leaders, speaking for themselves, criticised the "tinkering" of the New Deal as being harmful to both labor and capital.

Labor has finally recognized that its only hope lies in a free business not weighed down by heavy taxes, government restrictions on every hand, incessant regulation and a controlled money supply.

Labor sooner or later had to come around to this point of view because labor itself wants freedom, a thing it loses with socialized ownership. Labor's only opportunity, as shown by events abroad, lies in working for private ownership. If capital cannot expand without fear, then unemployment will continue to exist. Labor now knows that.

What is labor going to do about it? And what is capital going to do?

In the electrical utility industry, for instance, organized labor and capital have not had a friendly regard for each other. If private ownership is so essential to labor, one would think that labor would try to establish a new and better relationship.

What good can organized labor do for the utilities? Has labor declared itself on this point? Are there any mutual problems on which both can work together?

There is one immediate activity in which co-operation can produce results, and that is rewiring. If labor is serious about wanting to reduce unemployment, here is one place where it can help. The utilities will do the major part of the promotion and selling and jobs will be created. The extent to which this kind of work can be done quickly, inexpensively and with the minimum amount of disruption of the customer's business will determine the acceleration with which other jobs can be sold.

Will the union train its men for this class of work? Will it make available only men who are competent, quick, courteous? Will it do everything in its power to make this work go smoothly?

We have a feeling that a large part, if not all, unemployment among capable electricians can be eliminated in two years or less if the union will really and truly do its best to make this rewiring business easy to sell.

If labor and capital will take a year's vacation from distrust and try a year of working together they might find to their mutual astonishment that they had a lot in common and that together they could accomplish much more than they could singly.

A.I.E.E. Sessions

W. W. Edson, Boston Edison

SESSIONS at the winter convention of the American Institute of Electrical Engineers were more than ever of the symposium type, affording ample opportunity to canvass the ramifications of dominant problems confronting the power engineer. The trend toward oilless circuit breakers was exemplified by one group of papers contributed by three manufacturers. Another group from the operating side recorded the extensive plans of metropolitan companies to avert major interruptions and to restore service whenever large local areas are cut off by inadvertent system breakdowns. Movement toward a systematic patterning of line and station insulation on a basic setup of impulse and power frequency insulation levels marked another session.

Dependence of prompt relaying and isolation of faults upon the associated current transformers was recognized in a discussion which focussed upon the transient saturation and response to overcurrents of such transformers. Departure of watt-hour meters on short-cycle loads and on the current distortion of rectifier supply was explored and found not to be as serious as had been surmised by some in the absence of comprehensive tests.

Prospects for progress of electrotechnology and revival of activity in the field of transportation electrification were candidly discussed and the deterrents diagnosed. Extensive consideration of the newly developed amplidyne generator largely absorbed the industrial symposium; along with all these prevailing problems of the electrical art there were several informal conference sessions devoted to sound and vibration measurements, to correlation and revision of A.I.E.E. standards and definitions and to increased employment of electronic devices.

Interest in the well-timed programs was manifested by the large attendance and enlivened participation, particularly by manufacturers' engineers, in the program and discussions.

Restored Service in Metropolitan Areas

Restoration of Service from Large Metropolitan System After Complete Shutdown—By H. A. Dryar and Raymond Bailey (Philadelphia Electric).

Two backbones provided by 66 kv. and 220 kv. facilities. Generation and loads balanced in each area. Sectionalization, fault clearance, isolation and interconnections augment specific operating programs for restoration setup for various times, locations and extent of shutdown.

Design and Operation of a Metropolitan Electrical System from the Viewpoint of Possible Major Shutdowns—By S. M. Dean (Detroit Edison).

System mostly radial overhead, few circuits in excess of 1,500 kw. Five load areas are "loose-linked" for ready fall-apart so load can be picked up in small pieces. Steam-turbine-driven d.c. generators serve essential station auxiliaries (except boiler feed pumps); system shutdown will not affect station auxiliaries. Protected buses isolate faults. Emergency switching program setup for operators to sectionalize when "lamp voltage equivalent" at power plant falls to 80 volts.

Provisions for Re-energizing the Electric System of the Consolidated Edison Company of New York, Inc.—By G. R. Milne and H. C. Otten.

System a composite of radial in outlying boroughs and multiple-feed low-voltage network in Manhattan. Stations normally interconnected only by direct tie feeders and frequency changers (60/25 cycles). Load segregated into blocks small compared to station capacity interconnected. Ideal pattern given in detail. Contribution of cable limiters cited. Restoration after complete hypothetical shutdown starts with turbo-generators for auxiliary supply which will start on steam generated by natural draft in stoker-fired boilers. Alternators, frequency changers, remaining alternators, direct tie feeders, radial feeders follow in early stages of resumption procedure given in comprehensive detail. Flood restoration of September 21, 1938, outlined.

Restoration of Service on a Metropolitan Power System—By W. C. Bryson and A. P. Hayward (Duquesne Light).

Two 66-kv. rings constitute normal operation for system embracing three power stations and two medium capacity interconnections. Flood outage and restoration reviewed and plan for subsequent flood restoration detailed, as well as for shutdowns caused by failures not predetermined.

Too much emphasis had been placed on interruption and restoration in the titles of the papers, said both Chairman E. C. M. Stahl (Consolidated Edison) and P. B. Juhnke (Commonwealth Edison), who presented an interpretive prelude. They said extensive interruption on our large systems cannot be considered as likely in prospect. Complete shutdown, except for calamitous "acts of God," should not be envisioned. Equipment hazards were identified and can be limited in their effects

Explore Current Problems

if they eventuate, because there are reserves for that purpose. Such partial interruptions as have occurred were not in vain because the lessons learned from them were the stimulus behind the "frank and conscientious papers born of a true sense of public responsibility to be prepared."

The papers revived and recorded anew the varying philosophies of tight and loose system setups, rings and parallel backbones, network and radials, sectionalization and segregation. This was one session which utilities had all for themselves, and they were mild in their comments about the other fellows' system pattern. They put much emphasis on personnel training and personal responsibility of operators in emergencies, backed up generally by rehearsals, quizzes, "skull practice" and formulated sequences.

Incidental problems in the boiler plant were called to attention by W. E. Caldwell (Consolidated Edison), particularly the speed of response of the boiler. Some accumulator effect was desirable in the steam-combustion setup to coast over the fluctuations of demand arising in system emergencies. Boiler pickup rates of 35,000 lb. per hour per minute (stoker) and 50,000 to 120,000 lb. per hour rate in 27 seconds were mentioned. An instantaneous pickup of 25 per cent is a reasonable boiler plant expectation. Tests on one of the 50,000-kw. superposing turbines during December gave reassuring results with 15,000 kw. suddenly imposed on it; it did as well as the time-tested low-pressure units.

It is better to clear the bus in case of extensive trouble, said C. A. Corney (Boston) than risk a longer shutdown because of badly damaged equipment. He spoke of relaying and fire-fighting facilities as positive adjuncts of a restoration program. He questioned the Duquesne restoration of street lighting being high in the preferred list (in Boston it comes last), but got the answer that municipal authorities wanted it for policing evacuated flood areas.

W. J. Lyman sent in the assertion that "tight" systems offer better economy, but entail difficult and expensive protection. Reactors divide his (Duquesne) system into two rings with stability and ample synchronizing power.

Juhnke suggested that the ideal system would provide two parellel patterns, each fully adequate for the load, but that the practicalities were best met by confinement of fault areas. He liked the flexibility of the Philadelphia system as against the security of the Detroit scheme, which, he felt, presents operating limitations. He blamed relaying for many of the outages which had occurred on various systems because trouble was not isolated.

Non-Oil Circuit Breakers

The Cross-Air-Blast Circuit Breaker—By **D. C. Prince, W. K. Rankin** (both General Electric), and **J. A. Henley** (Metropolitan Vickers Co., Ltd.).

Limitations of European designs analyzed. Presents evidence that this breaker operates predominately on the displacement theory, is much less sensitive to recovery rate and high currents, as well as more economical in air consumption than previous air blast breakers.

Design and Construction of High-Capacity Air-Blast Circuit Breakers—By **H. E. Strang** and **A. C. Boisseau** (both General Electric).

European limitation to 40,000 amp. elevated here to 60,000 amp. afford interrupting rating of 1,500,000 kva. Gives design details and test results. Oilless breakers for indoor service reported now to be available in interrupting ratings covering range of oil breaker ratings.

A New 15-Kv. Pneumatic Circuit Breaker—By **L. R. Ludwig, H. L. Rawlins** and **B. P. Baker** (all Westinghouse).

High operating speed, rapid interruption with minimum energy dissipation; 1,500,000 kva. at 15 kv. Uses compressed air stream transverse to the arc. Currents

C. F. Scott, Yale University

as high as 65,300 amp. interrupted in test at 13.2 kv. single phase with contact operation of approximately 2 in., mechanically obtained in ½ cycle.

Magnetic Deion Air Breaker for 2,500-5,000 volts—By L. R. Ludwig and R. H. Nau (both Westinghouse).

Efficacy at and above 150,000 kva. with 2,500 to 5,000 volts demonstrates practicability of gas blast produced by intense transverse field. Noise greatly reduced. Ionized byproducts so controlled that unusual barriers not needed.

Circuit Interruption by Air Blast—By W. S. Edsall and S. R. Stubbs (Allis-Chalmers).

Prestored compressed air both operates and interrupts (without oil) same range of interrupting capacity steps and voltages as the oil breaker, indoor and outdoor. Gives control over magnitude and rate of recovery voltage rise. Fast reclosing facilitated.

Large attendance and considerable unanimity marked the session on non-oil breakers, with most of the discussion being by manufacturers on one another's papers. Joseph Slepian (Westinghouse) reviewed his lack of faith in the displacement theory apparently propounded in the first paper on the cross-air blast and showed enlargements of the author's arc pictures in support of his contention for diffusive turbulent phenomena in the arc chutes. J. B. MacNeill (Westinghouse) remarked upon this first-time group of papers advocating use of compressed gas for circuit interruption for high-power indoor equipment and explained why Europe had preceded us in the developments. He emphasized that types of interrupters have been found which will function with moderate gas pressures and simple mechanical structures easily inspected and maintained, fitting nicely into housings and of reasonable cost. They provide necessary speeds and are adaptable to reclosing without greater derating than oil breakers. He mentioned the negotiations in progress to standardize these newer breakers up to 34 kv., but urged a tentative standardization; 150 lb. air pressure might well cover American requirements.

H. P. St. Clair (American Gas & Electric) saw in the first two papers a beginning on the problem of relating the recovery characteristics of the breaker with that of the circuit and said that progress was being made in ascertaining the values of rate of rise of recovery voltage for systems.

R. J. Wensley (I-T-E) welcomed other producers to the air breaker field, to which his company had held exclusively for 50 years. He was disposed to attribute the chute action to simple thermal functioning and expansion and said the crux of the air-blast breaker was the air-blast valve, particularly for outdoor service. D. C. Prince (General Electric) feared the design described in the fifth paper would be extravagant in use of air for large ratings and that air and arc might tend to choke with axial blast through the throat.

C. M. Gilt (Consolidated Edison) cautioned that the air breaker would have to compete with the oil breaker and reminded that the latter has had extremely few oil fires, but agreed to the desirability of eliminating oil if attainable at reasonable cost. Air systems are a handicap, but not prohibitive. He favored combining all operating function in one mechanism. H. C. Lewis (Baltimore) did not get a wholly conclusive answer to his question as to what would happen if one of these new breakers failed and projected an arc outside it.

H. V. Nye (Allis-Chalmers) did, however, state that the answer was presumably in having an adequate margin of capacity backed by thorough factory tests. Anyhow, this was the first time in circuit breaker history that makers have produced something "which you don't have to worry about."

English Electric designs of 138-kv., 800,000-kva. breakers were described by H. W. Haberl (Montreal) as having given a good account of themselves as to operation and maintenance. Activated aluminum is used for drying the 90-lb. air from the plant supply. They had had fourteen automatic operations at 800,000 to 1,000,000 kva. in eleven breaker-years of service.

Hydrogen-Cooling Experience

Application of and Operating Experience with Hydrogen-Cooled Synchronous Condensers and Alternators—By Philip Sporn and F. M. Porter (both American Gas & Electric Service).

Reviews results (over twelve years) with eight condensers and two alternators with descriptions of installations, operation and maintenance, loss reduction, explosive hazards, use of higher pressures, etc. Reliability of condensers as great as or greater than air cooled. Gas consumption negligible. Accessories reliable. No concern on safety. Five-year inspection interval. Outputs exceed by 25 per cent (with additional 20 per cent at 15 lb.). Helpful on heavy swing loads. No shortening of insulation life anticipated. Expect duplication of similar benefits with alternators.

C. M. Gilt (Consolidated Edison), reporting his company's "generally very encouraging" experience with

Edward Beck, Westinghouse; I. W. Gross, A.G.&E. Service Corporation; P. L. Bellaschi, Westinghouse; F. H. Hollister, Sargent & Lundy; A. J. Krupy and H. E. Wulfing, Commonwealth Edison; F. H. Lane, P.U.E.&S. Corporation; L. R. Mapes, Illinois Bell Telephone

hydrogen-cooled equipment, said that two 65,000-kw., 0.8-p.f. units are on order for the same plant in addition to two 53,000-kw. units running.

Hydrogen cooling was introduced on the first 53,000-kw. unit on July 6, 1939, and on the second unit in June, 1938; up to January 1, 1940, the first machine had 4,156 hours of operation in hydrogen and the second 11,762 hours. Equipment is of the low-pressure type, maintaining a pressure of less than ½ lb.; one of the new units will be designed for low-pressure operation with provision so that pressure can be raised to 15 lb. Generator is scavenged with CO_2 in changing from air to hydrogen or the reverse. About 1,900 cu.ft. of hydrogen is used to fill unit with hydrogen volume of 1,400 cu.ft.

F. A. Lane (American Gas & Electric) supplemented the paper with details of operating experience at Logan and Windsor plants. From 1937 to September 30, 1939, the 50,000-kva. alternator at Logan had given 400 days of service without any lost time because of trouble with the generator or with hydrogen-cooling equipment and control. Using ½ lb. pressure, it had carried 48,000 kw. (20 per cent above rating) at 99 per cent p.f. for an hour. New refinements are needed in purity indicators, which now have an accuracy between 2 and 3 per cent. Hydrogen cost was about $275 per year, operating at ½ lb. pressure.

Mr. Lane reported that the 66,667-kva. hydrogen-cooled turbo-generator at Windsor from April, 1939, to September 30, 1939, had given 118 days service without lost time. It had operated for an hour at 62,000 kw. and 64,500 kva. Hydrogen purity had been maintained at 98 per cent.

As "significant of the rapid acceptance by the power industry" of the hydrogen-cooled generator, D. S. Snell (General Electric) reported that his company has placed in service to date fourteen hydrogen-cooled generators with a combined capacity of 863,800 kva. and now has under construction 29 additional hydrogen-cooled generators, with a total capacity of 1,578,000 kva. S. H. Mortensen (Allis-Chalmers) described the oil film seal development of his company (ELECTRICAL WORLD, October 7, 1939) to prevent leakage of hydrogen along the turbine shaft.

M. D. Ross (Westinghouse) reported that his company is building two hydrogen-cooled synchronous condensers without purity indicators, the purity maintained in practice being the basis for this step.

Insulation Co-ordination

Basic Impulse Insulation Levels—By **Philip Sporn** (Amer. Gas & Elec. Serv.) and **C. A. Powel** (Westinghouse).

Reviews NELA-NEMA program initiated in 1931 for co-ordination toward localization of lightning breakdowns and establishment of insulation levels. Paper suggests modification of basic impulse insulation levels agreed upon in 1937. Proposed new definition puts insulation levels on a "withstand" rather than "flashover" basis so as to eliminate tolerance factors. This involves a 5 per cent reduction in values for all voltage reference classes; however, equipment carrying power-frequency voltage ratings of "reference class" values is not necessarily required to have the tabulated impulse levels since the assigning of equipment to certain levels is a problem distinct from establishing impulse levels as a pattern of standardization.

The Co-ordination of Electrical Equipment with Basic Insulation Levels—By **J. H. Foote** and **J. R. North** (Both Commonwealth & Southern).

(1) Maximum dynamic line-to-ground voltage at the apparatus largely determines its basic insulation level. (2) In selection for insulation strength, it is necessary to take into account the low frequency and impulse levels. (3) Nameplates should carry "low frequency withstand" and "impulse withstand" voltage levels.

Rationalization of System Insulation—III. Margins Between Basic Insulation Levels and Protectable Levels—By **Philip Sporn** and **I. W. Gross** (both Amer. Gas & Elec. Serv.).

(1) Impulse margins for arresters appear adequate, but caution is expressed against placing too much reliance on them when located at some distance from protected equipment. (2) As a reasonable margin between basic impulse insulation level and *IR* drop characteristic of arrester it is suggested that the latter increased by 10 per cent and 25 kv. should not exceed the B. I. L. (3) Eventually similar margins for equipments forming parts of any given transmission system will round out the current program of establishing basic levels.

Proposed Standards for Outdoor Bushings—By A.I.E.E. Joint Committee on Bushings (**R. T. Henry, J. E. Clem** and **J. R. North**).

Allows for dynamic overvoltages and switching and lighting surges. Bushings with same characteristics for transformers, breakers and equipment of corresponding voltage ratings. Lower values of insulation strength may be assigned for bushings for small breakers, distribution transformers, etc., where space or other limitation may require smaller bushings and where a smaller margin of protection may be satisfactory.

M. A. Edwards, General Electric; C. W. Willis, Princeton

Recommendations for High-Voltage Testing—By **EEI-NEMA Joint Committee on Insulation Co-ordination.**

Presents guidance for uniform impulse testing of insulation. Reconciles former discordances. Offers new recommendations for details of wet flashover, definition of critical flashover (50 per cent of the test applications), for rated "withstand" impulse values and for correction factors for variants.

Cautious approach toward tentative adoption of a régime of basic impulse insulation levels was the theme of this session. Two schools were manifested, one strongly typified by J. H. Foote's (Commonwealth & Southern) plea that the committee and paper proposals be viewed as fundamental guidance, in no way tying the hands of the engineer who wanted to make his own selection and allocation of apparatus voltage levels. Others, principally manufacturers, were for delaying procedure until the engineering and economic factors associated with transition away from dual standards and stocks could be resolved. In particular he differed with J. B. MacNeill's (Westinghouse) suggestion that manufacturers be allowed to name performance potentialities having limited conformity to a pattern of basic insulation levels.

Several discussors emphasized the fact that the residual vagaries of lightning in conjunction with the un-

certainties of the arresters made the arrester the point of departure for the whole program of the insulation-level pattern. R. L. Whitney (Westinghouse) cautioned that adoption of the proposals might duplicate stocks and molds for insulators and questioned putting greatly outnumbered bushings in the same category with apparatus insulators. He wanted to know if the industry contemplated wholesale replacement of insulators if the program became effective. E. S. Cornell (Delta-Star) said four apparatus insulators (23, 34.5, 46, 69 kv.) were now about 5 per cent below the proposed "BIL" values. It would be almost impossible to redesign them to conform and have the same dimensions. He favored acceptance of present standards until there is further experience with co-ordination. K. A. Hawley (Victor) added that some designs "superseded" twelve years ago were still being called for in orders, largely for dimensional reasons. D. C. Prince (General Electric) was disposed to urge that different BIL values could well be set up for different categories of equipment.

C. A. Powel (Westinghouse) on his own behalf said this was not an academic matter, but one of real economic significance, and (speaking for J. B. MacNeill) that there were many factors built in by an experienced manufacturer based on circumstances not covered by the tests and these should be recognized by the user; the papers should help lessen the need for buying overvoltage equipment.

Speaking of older equipment, H. K. Sels (Newark) found the steps in insulation strength went "down cellar" instead of "up attic" in accordance with co-ordination requirements. Every five years it seems necessary "to celebrate co-ordination by replacing or rebuilding arresters. It is too much like leaning on a crutch."

Relays

Overcurrent Performance of Bushing-type Current Transformers—By **C. A. Woods** and **S. A. Bottonari** (both Westnighouse).

For purposes of circuit protection application the ratio and phase-angle characteristics need to be supplemented by response to undirectional components of fault transients, particularly for high-speed relays. Matching of saturation characteristics important; open circuit saturation curves and loss data explored.

A Proposed Method for the Determination of C. T. Errors—By **G. Camilli** and **R. L. Ten Broeck** (both General Electric).

Proposes indirect method to avoid the difficulties of direct determination with heavy fault currents; calculates ratio and phase-angle errors from impedance and excitation characteristics.

Analysis of Bushing Current Transformer Performance—By **J. P. Gebelein** (Consumers Power) and **J. A. Elzi** (Commonwealth & Southern).

(1) Cores of adequate volume and reasonably high turn ratio are desirable. (2) Performance can be estimated from the components of excitation current. (3) Excitation plus burden impedance gives basis for current division with interconnected secondaries. (4) Two in series is equivalent to half reduction of burden.

Transient Characteristics of Current Transformers—By **A. T. Sinks** (General Electric).

Factors recognized (as transcending steady-state overcurrent accuracy) and explored are: Interference through proximity, residual flux in core and the magnitude and time constant of the d.c. transient of primary current.

Current Transformers and Relays for H. S. Differential Protection, with Particular Reference to Offset Transient Currents—By **E. C. Wentz** and **W. K. Sonnemann** (both Westinghouse).

Discusses the determination of actual performance of existing C. T. and presents approximate solutions to aid in retention or selection. Protection engineers underestimate the relative saturating effect of d.c. in asymmetrical currents. Arrives mathematically at formulas for predicting approximate currents in differential relay circuits because of non-linearity of current transformers. Tests confirm the conclusions.

Trend away from time-delay toward high-speed protection, particularly the instantaneous for internal faults, has accentuated the need for more data on the response and accuracy of current transformers, particularly the bushing type, said J. R. North (C. & S.) in introducing the first author. In fact, H. P. Sleeper (Newark) felt that the information presented should have been available ten years ago. In a recent indoor bus modernization his company had discarded time delay and "double relays with multi-restraint" in favor of an oversize current transformer for the protective installation; it was 20 in. square, had an 8-in. aperture, weighed 600 lb. and "was not cheap." P. O. Langguth (Westinghouse) said the emphasis on saturation of the cores by the fault transients would impose on the manufacturers the responsibility of supplying information for use by purchasers. He suggested using as a benchmark for saturation analysis a point beyond (say 10 amp.) the linear part of the curve, it would be less vague than specifying the "knee." Less reliance on ratio and more on excitation was indicated by H. A. P. Langstaff (West Penn), who asserted that publication of loss data and saturation characteristics for newer transformers would be of great help to the protection engineer and he hoped they could be obtained for transformers now in service. Prof. W. A. Lewis (Cornell) mentioned that induction relays run slow on harmonics because there is less fundamental component and less torque from harmonic components. The focus on saturation was favored by E. L. Harder (Westinghouse) for application work, but he doubted whether it lends itself to a standardization régime. The error current is readily determined without interpolation for different burdens and burden power factors. It meets the situation when circumstances saturate one current transformer, but not the interconnected ones. The saturation curve and secondary leakage impedance information provide necessary data for asymmetrical current conditions.

Watt-Hour Meter Performance

Watt-Hour Meter Performance with Power Rectifiers—By **C. T. Weller, H. E. Trekell, F. O. Stebbins** (all General Electric).

Accuracy of typical polyphase watt-hour registering 6- and 12-phase mercury-arc power rectifier loads is found to be well within 1 per cent. Meter speed is decreased at light load, but in the case of 6-phase is increased at higher rectifier outputs. For a var-hour meter the corresponding departure would be within 2 per cent.

The Accuracy of Watt-Hour Meters on Intermittent Loads—By **M. A. Faucett, C. A. Keener, M. S. Helm** (all of University of Illinois).

(1) Acceleration and deceleration of disk largely determine performance on intermittent load. (2) Performance bettered by reduced current damping torque in modern meters. (3) Maximum error indicated (possibly 20 per cent) to occur at 2 to 4 cycles of accelerating period. (4) Light load adjustment extremely important; 30 per cent error may occur if meter is on verge of creeping; minimum friction and minimum friction compensation desirable. (5) Power factor of intermittent load not a critical factor. (6) Newer meters with decreased accelerating time (in-

F. R. Longley, Western Massachusetts Companies; Robert Treat, General Electric; E. E. George, Phoenix Engineering; L. F. Hickernell, Anaconda; J. W. Bennett, Western Massachusetts Companies

creased ratio of torque to inertia) better than old on intermittent loads. (7) Torque equation analyzed for source of acceleration error.

A Precision Rotating Standard for the Measurement of Kilowatt-Hours—By J. H. Goss and A. Hanson Jr. (both General Electric).

A number of readings must be taken and weighted. Photo-electric timing is an adjunct to an improved scheme for maintaining the value of the kilowatt-hour to be used for calibrating and checking portable standard watt-hour meters. Presents a convenient chart of probable errors in the calibration stages.

How accurate is a watt-hour meter on such loads as flashing signs and welders (with intermittent cycling) and rectifiers (with current distortion)? The consensus after discussion of the papers was that they were much better than some had suspected (or even demonstrated in the papers). That it is important to know these things was evidenced by I. E. Weston's citation of 200,000 kva. of rectifiers on the New York Board of Transportation's subway system. Hamilton Treadway (Illinois Commerce Commission) sent in the suggestion that it may become necessary some day to take cognizance of the character of such loads in conjunction with meter test rules and techniques.

Much comment on the University of Illinois paper was querulous. A. B. Craig, through T. H. Haines, told of Boston tests by Ingalls years ago made with segmented rotating switches to halve or otherwise apportion the cycle load through one meter, while leaving it constant and continuous on another. They believe the maximum meter error is nearer 1½ per cent in the critical 1–3 cycle region than the values reported. Professor Burckmyer (Cornell) preferred reference to ballistic wattmeter readings for comparisons on brief duration loadings. Several questioned the authors' methods of adjusting the highly critical friction compensation during their tests, particularly if it has to be different from adjustments for ordinary loads.

H. E. Trekell (General Electric) said tests on single-phase production meters showed less difference between starting and stopping than the authors reported; current damping is missing in the stopping phase, but this is only about one per cent of the torques involved. They found about one-fifth the departure reported by Faucett-Kenner-Helm, and even some errors on the slow side. Walter Wagner (Philadelphia Electric) said field studies were needed, that inductance of d.c. loads on rectifiers made a difference. He mentioned development of an electrodynamic wattmeter with added integration for watt-hours.

E. S. Lee (General Electric) said the watt-hour meter was still an "amazingly reliable bird" regardless of what queer electrical conditions it had to register.

Lightning Protection

Lightning Protection of Wood-Pole Lines—By H. K. Sels and A. W. Gothberg (both Pub. Serv. Elec. & Gas).

Two years experience with 60 miles of line rebuilt to utilize impulse strength of wood insulation shows better than 90 per cent reduction in lightning outage. One phase conductor is protected with 100,000 impulse-ampere protector tubes and so placed as to shield the two others from direct strokes; the remaining phases are isolated from the shielding conductor and tube ground circuit by insulation (including wood braces) sufficient to prevent phase-to-phase faults. Tubes use galvanized pipe fittings with nail electrode. In 1940 another 90 miles will be similarly reconstructed.

Lightning Currents in Arresters at Stations—By I. W. Gross (Am. Gas & Elec. Serv.) and W. A. McMorris (General Electric).

Report of joint field investigation of discharges through 459 distribution arresters affords seventeen conclusions, among them: A 15,000-amp. maximum found, repeated discharges through same arresters, 3.5 per cent more than 5,000 amp., seven-eighths negative polarity, higher discharges through arresters on wood-pole lines without ground wire and two-thirds of the cases were multi-phase, multiplied arresters at station buses discharge in parallel.

Inclosed Spark Gaps—By W. E. Berkey (Westinghouse).

Accounts for low impulse ratios observed with rutile spacer spark gaps, "quench gaps," "ionization gaps" and

high-voltage arrester spark gaps generally. Some form of ionizing radiation essential.

Lightning and Lightning Protection of Distribution Systems—By **R. C. Bergvall** and **Edward Beck** (both Westinghouse).

Correlates experience and test data on arrester discharge currents with arrester failure rate. Discharge currents of low magnitude and long duration are more likely to cause arrester failure than very high currents of short duration. Long low current components frequently appear in strokes to tall conductors and possible in struck lines. High soil resistivity makes for high failure rates, but not invariably. Practical problem concerns discharges through arresters in service.

Station-Type Lightning-Arrester Performance Characteristics—By **Protective Devices Committee.**

Gives, for arresters of 3 to 242 kv. to ground, the gap breakdown values (average, minimum, maximum) and the *IR* discharge voltage values for 1,500, 3,000, 5,000, 10,000 and 20,000 amp. based on a 10–20 current wave. All in tabular and graphical form.

Predictions of two years ago by the Public Service authors of a 75 per cent reduction had been more than confirmed, noted Edward Beck (Westinghouse), but he was glad to see they hardly expected the 100 per cent reduction in the 1939 season to be continued. E. J. Allen of the same company remarked that their scheme was practically equivalent to an overhead ground wire and showed allowable stroke currents for various ground resistance values for application of protector tubes solely to top conductor with various impulse flashover values from ground wire to shielded phase conductors. He also mentioned that tube operations (105 out of 341) were 5.7 per mile per year in 1938, but only 1.8 in 1939 (108 out of 830) in 1939, despite a 40 per cent increase in number of thunderstorms.

H. P. Sleeper (Newark) facetiously decried the tone of papers which purport to solve a crucial problem completely and finally. The greatest contribution to service rests in fault-extinguishing devices, he said, and advocated consideration of both Petersen coils and expulsion tubes. Perfect performances of these two system protection means would eliminate much terminal relaying complexity.

On the Gross-McMorris paper Beck was impressed by its courage in essaying to state how many instances of apparatus damage are prevented by arresters. S. K. Waldorf cited two Pennsylvania Water & Power 132-kv. lines operating successfully for six years without arresters; they are of little use on well-protected and well-shielded lines. H. N. Ekvall (Philadelphia) said extensive resort to wood insulation technique had effected an 89 per cent reduction in interruptions with comparable results on 33-kv. He believed there could have been a corresponding 82 per cent reduction on the Public Service without arresters or tubes and suggested consideration of their omission on the 90 miles announced to be equipped this year. H. K. Sels answered by saying Philadelphia may unwittingly be using crossarms as deionizing agents.

D. C. McCarthy (General Electric) agreed with Bergvall and Beck that still more data on wave shapes of impulse currents is needed despite the many researches. He felt that the difference in current drainage between urban and rural circuits may account for higher failure rates of lightning protective devices sometimes experienced on rural circuits. I. W. Gross (American Gas & Electric) was disposed to ask, on the strength of the same paper, why not put distribution arresters at the stations and omit the line arresters for economic gain? C. A. Patteson (Pennsylvania Electric) emphasized permanent sealing of arresters to preclude breathing and avert radio interference troubles.

Impulses on Transmission Elements

Engineering Features of the 230-Kv. Boulder-Chino Line of the Southern Edison Company, Ltd.—By **A. A. Kroneberg** (Southern Cal. Edison) and **E. M. Hunter** (General Electric).

Reliability objective met by ground wires, counterpoises and ground-fault neutralizers (Petersen coils) at terminals. Line carries load near steady-state stability limit. Single-circuit closely approaches reliability of dual line on separate rights-of-way with crossovers and paralleling switching stations. Petersen coils neutralize single line-to-ground faults to which flashovers are reduced by overhead ground wires and occasional counterpoises. Ground-fault neutralizers installed cost less than 5 per cent of second line and these are expected to function with in-phase components of the order of 80 amp.

Some Impulse Voltage Breakdown Tests on Oil-Treated, Paper-Insulated Cables—By **C. M. Foust** and **J. A. Scott** (both General Electric).

Data presented covering insulation thickness range from 0.187 to 0.600 in. Average stress at breakdown approximates 1,600–1,700 volts per mil. High-density papers show some superiority over ordinary-density papers. Oscillograms of test wave before and at breakdown included.

What Wood May Add to Primary Insulation for Withstanding Lightning—By **J. T. Lusignan** and **C. J. Miller** (both Ohio Brass Company).

Reports results of impulse tests. Supplemental effect of wood against lightning shown to depend almost entirely upon length and internal moisture and little upon creosoting treatment, cross-section or kind of timber. Curves devised for structural designers present values for wood to be added to primary insulation to predetermine impulse strength and ratios for variants of moisture, preservative retentions, rain, etc.

C. A. Carney, H. C. Hamilton, T. H. Haines, all of Boston Edison

Surge Characteristics of a Buried Bare Wire—By E. D. Sunde (Bell Telephone Laboratories).

Mathematics and test substantiation bring quantitatively into the analysis the range of earth dielectric constant, capacitivity and inductivity. Summary curves give (1) propagation of surge in infinitely long buried wire and (2) the surge impedances with microseconds to account for reflection effects.

Impulse Strength of Cable Insulation—By E. W. Davis and W. N. Eddy (Simplex Wire & Cable).

Conclusions reached: Impulse strength not critically affected by shape or polarity, type of electrode or length of specimen; "strength of rubber decreases with increasing wall"; varnished cambric about 1,000 volts per mil and oil paper about 3,000; each three to four times 60-cycle strength, but rubber about two times; an impulse fault in cambric has higher a.c. strength than one in rubber.

C. M. Laffoon, Westinghouse; C. L. Dawes, Harvard; I. E. Moultrop, ex-vice-president A.I.E.E.

Commenting on the Kronebergh-Hunter paper, E. T. B. Gross (Cornell University) said that the uncompensated fault current of around 80 amp. obtained in tests of ground fault neutralizers on the line seemed high. This value is about 25 per cent of the estimated fault-charging current, whereas in comparable uses of Petersen coils in Europe the ratio of residual to total charging current is of the order of 10 to 15 per cent.

The tenor of the Davis and Eddy, of the Foust and Scott papers and of the discussion on them indicated that the impulse strength of cable insulation is a field of exploration not yet even well surveyed. Certain statements and intimations in the papers inspired opposition in the discussors as, for instance, the implied hopefulness in favor of rubber insulation by Davis and Eddy was contested by L. F. Hickernell (Anaconda) with the argument that rubber, being a solid structure, may not have as great dielectric strength as a laminated one like the layers of paper tape. L. G. Smith (Consolidated Gas, Electric Light & Power) said he'd like to see such tests on aged cable since there was a whole lot of that in service. Herman Halperin (Commonwealth Edison) pointed out that the high impulse strengths shown by laboratory samples might not be duplicated by complete lengths in service. R. W. Atkinson (General Cable) said that in general the test results reported in the two papers corroborated the findings of tests made by his company. In response to a point previously raised in the discussion he indicated his belief that surge tests had no harmful effect on the cable tested. W. A. Delmar (Habirshaw) drew attention to the large range in volts per mil of insulation thickness stated in the papers and inquired why. L. I. Komives (Detroit Edison) was curious to know why the impulse tests described in the papers were started at lower voltages and not at the final high points. Also, he wanted to know if the tests had brought out any information on the importance of taping uniformity. That the data brought forward in the Davis and Eddy paper indicate the need for further investigation before rubber is accepted for high-voltage cable insulation was suggested by R. B. McKinley (General Electric). C. M. Foust (General Electric), arguing from tests made by G. E., was inclined not to agree with the conclusion of Davis and Eddy that a cable having an impulse breakdown might remain in service for some time.

Paralleling the Lusignan and Miller paper, E. P. Brantley (Georgia Power) reported on extensive tests on wood insulation made by his company. These tests, he said, amply justified the practice of pre-drying crossarms. J. H. Hagenguth (General Electric) remarked upon the close agreement of rigorously calculated results reached in the Sunde paper with conclusions derived from empirically figured and experimental results by other investigators. It may now be accepted, he indicated, that (1) the surge impedance of a buried wire rises rapidly from zero to a maximum value and then decreases slowly to a value equal to the direct current resistance of the wire to the ground plane, and that (2) the maximum value of the surge impedance is a function of the front of the applied wave.

Power for Electric Welding

Power-Factor Correction of Resistance-Welding Machines by Series Capacitors—By L. G. Levoy, Jr. (General Electric).

Intermittent character of load often makes correction by shunt capacitors unsatisfactory. Precharged series capacitor energizes welders without transients and with complete correction of power factor; minimizes flicker. Should promote use of large deep-throat welders previously considered impractical because of excessive kva. demand. Tends to lower peak of kva. demand for user.

Resistance Welder Installations—Subcommittee on Power Supply for Welding Operations.

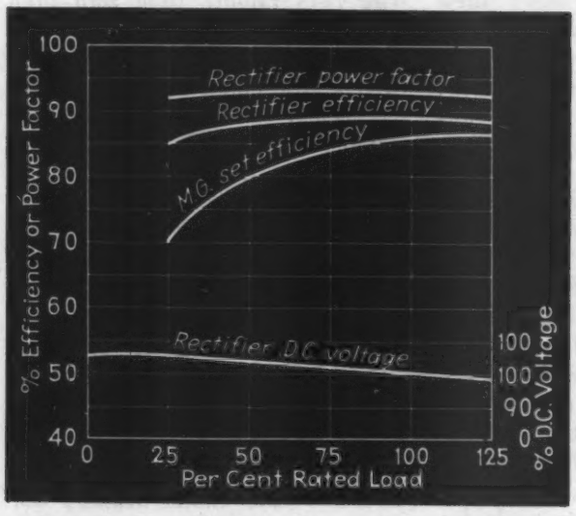
This second report discusses adequacy and appropriateness of various feeder distribution systems and gives utility and user circuit and apparatus details and proportions for six characteristic installations. Given are transformer capacity and connected load, type of welding service, and ratios (1) load to supply, (2) largest single welder to total supply capacity (transformer), (3) thermal load to total connected load.

[*Continued on page 121*]

Selects Glass Tube Rectifier for Shop D.C. Supply

High efficiency and overload capacity influence selection of low-capacity, permanently evacuated, glass tube rectifier over rotary conversion equipment to serve fluctuating d.c. load

HAVING MADE the prudent decision to modernize power facilities by purchase of electric power to reduce costs and relieve management of detailed plant management problems so that they could devote their full attention to manufacture of paper-making machinery, the Beloit Iron Works of Beloit, Wis., was promptly faced with a new problem. Hoists, elevators, cranes and machine tool equipment in the shop needed a flexible yet efficient source of d.c. power. Some type of conversion equipment was necessary. Why the company decided that mercury-arc rectifiers were the wisest choice for their conditions and how they executed the first 250-volt installation of a new type permanently evacuated, air-cooled glass tube rectifier in the country is of significance to other industrial concerns whose d.c. requirements range up to 500 kw.



Rectifier has high efficiency and power factor over wide range of load

Until the late summer of 1939 the Beloit Iron Works used two steam turbine sets to generate both their a.c. and d.c. power requirements. These turbine sets will now be used only during winter heating months for a heating balance operation. One turbine, a 450-kw. machine, drove both a 250-kw. d.c. generator and a 250-kva. a.c. generator. The other, a 250-kw. machine, was used with a 120-kw. d.c. and a 156-kva. a.c. generator. The maximum a.c. load drawn from these machines was about 200 kw. The d.c. load on the machines, however, ranged from a few kilowatts up to a maximum of 1,250 amp. at 240 volts or about 300 kw., depending on a variety of factors. It is important to note, however, that it varied widely.

Conversion equipment to supply this varying d.c. demand, therefore, had to be capable of combining flexibility in meeting this varying load condition with high efficiency over a wide range of load. In addition, sudden increases in load imposed by operating of large overhead cranes handling heavy castings made it desirable to seek equipment having high momentary overload capacity.

Careful comparisons between motor-generator sets, converters and mercury-arc rectifiers showed that for about the same per-kilowatt cost installed rectifiers possessed the following advantages:

1. High conversion efficiency, substantially constant over a wide load range—85 per cent at 25 per cent load and 89 per cent at 100 per cent load. (The accompanying curve compares efficiency of rectifier installed with efficiency of induction motor-driven m.g. set.)
2. High power factor under variable load—93 per cent lagging.
3. High momentary overload capacity—25 per cent for two hours—100 per cent for one minute.
4. Small no-load idling losses—6 kw. or 2 per cent of F. L. rating.
5. Extreme flexibility in meeting changing load conditions.
6. No rotating machinery maintenance or special foundations.
7. Easily adapted to automatic control.

A 300-kw., 250-volt rectifier of a new permanently evacuated, air-cooled glass tube design, recently introduced by the Allis-Chalmers Company for low-capacity industrial service, was selected by the management. Lack of extensive operating experience with prior installations of these rectifiers for industry in this country was not deemed a deterrent to the use of this equipment by the Beloit company, which cherishes a tradition for "pioneering."

The rectifier unit consisted of four factory-wired and assembled rectifier cubicles, 40 x 40 x 90 in. high, each containing a 6-anode glass-tube rectifier of 400 amp. capacity at 250 volts, complete with motor-driven cooling fan, dry-type ignition and excitation devices. The rectifier has an inherent

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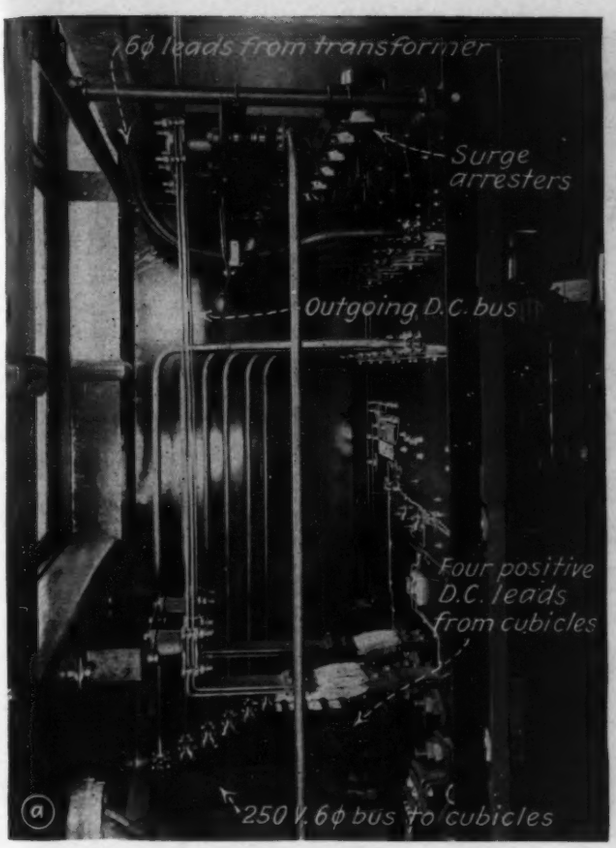
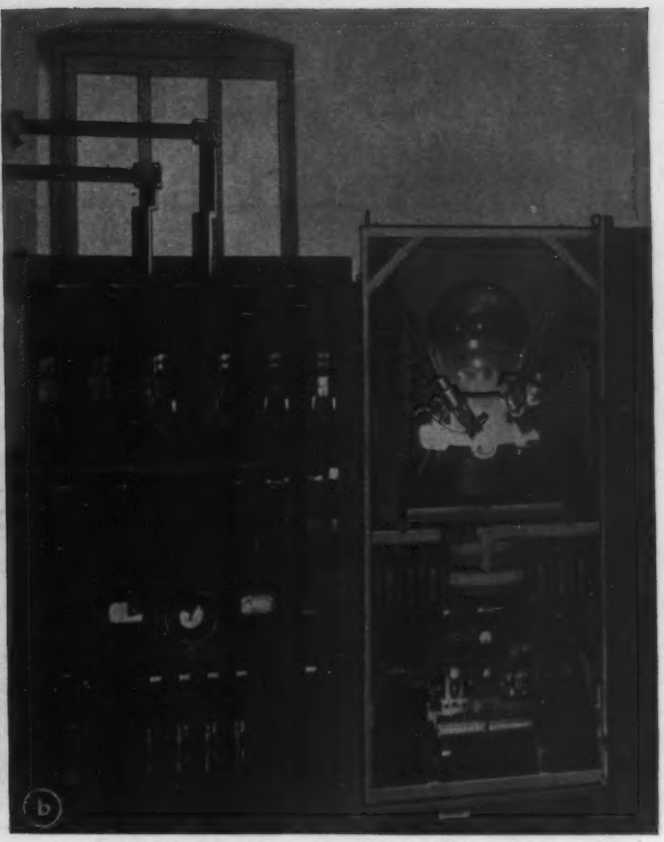
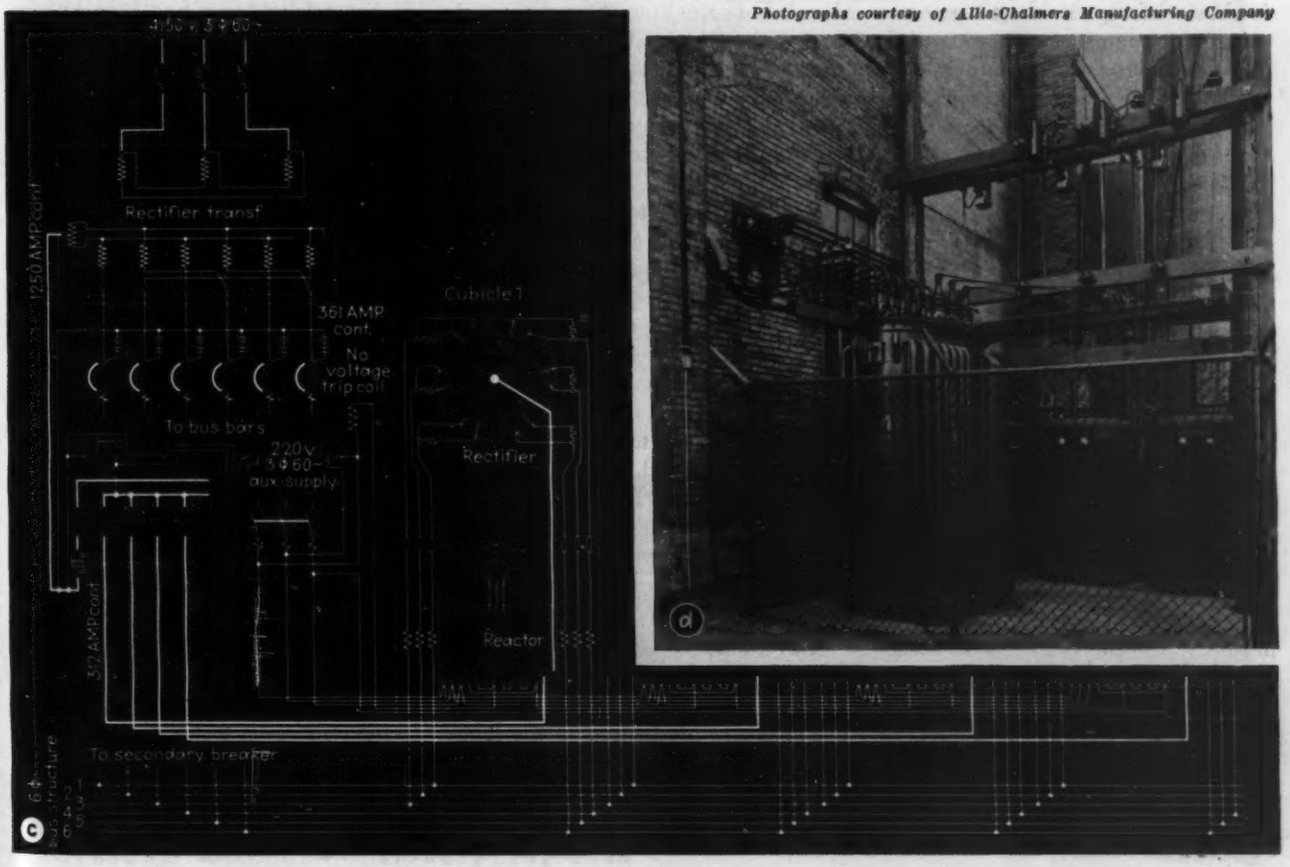




Switching and supply arrangement for the mercury-arc rectifiers is simple, as appears in picture "b." At the left is the switching and control board with the 235-volt, six-phase, air circuit breaker at the top and at the bottom the negative main d.c. switch, with the four switches alongside for paralleling the rectifiers on the d.c. bus. To the right in this picture is the first of the four rectifier cubicles with the door open and the permanently evacuated glass tube—400 amp., 250 volts—in operation. The picture "a" is a view behind the control board with the principal elements identified. At "c," below, is a schematic diagram of the installation and at "d" the input transformer, 360 kva., 4,150/235 volts, 3- to 6-phase.

Photographs courtesy of Allis-Chalmers Manufacturing Company



Wave Shapes of Successive Lightning Current Peaks

So-called repetitive strokes are continuous with several current peaks — The 1.5 x 40-microsecond test wave substantiated — Slow rate of rise confirmed for test of low-voltage apparatus

K. B. McEACHRON, *General Electric Company, Pittsfield, Mass.*

DURING the summer of 1937 nineteen oscillograms of current in direct strokes to the Empire State Building were obtained for which there was also available moving lens photographs, taken from a point 2,410 ft. away. The correlation between the photographic and oscillographic results were excellent, it being possible to identify each change of density on the photographic film with a corresponding change in measured current. Using both of these means together left no uncertainty as to the correctness of registration. Such a record is shown in Fig. 1. In no case was any suggestion of an oscillation of the current to be found on any of the oscillograms. Nine additional oscillograms were taken during the daytime, for which no photographs are available.

Out of the total of 27 oscillograms, three were found in which the current, which was initially negative, changed to positive at or toward the end of the period of current flow. All others began negative, *i.e.*, building top positive, and remained so to the end of the stroke.

Continuing Strokes the Rule

A continuing stroke is one in which the current continues for a relatively long time, with or without superimposed current peaks. Such a discharge is shown in the oscillogram in Fig. 2. Formerly such a discharge was called a multiple or repetitive stroke, but data now available indicate that the current does not in general cease until the stroke is completed. The current between peaks may be but a few amperes (less than 10), or it may be of the order of several hundred amperes. The peaks may occur at any time within the period of discharge—as many as forty having been observed in one lightning stroke. Due to the mechanism of the lightning stroke, it seems likely that most strokes to transmission lines and other objects of similar height above the earth will begin with a current peak. There is no reason to believe that the first peak is necessarily the highest, subsequent peaks may be higher. Data now in hand indicate that 80 per cent or more of strokes will have more than one current peak. The duration of the total stroke will depend upon the ability of the cloud to supply sufficient current to keep the discharge path ionized.

In an investigation reported in 1934* of the operation of expulsion tubes on the Roanoke-Glenlyn 132-kv. line of the American Gas & Electric Company one discharge was indicated having twelve current peaks of sufficient magnitude (probably 5,000 amp. or more) to cause the expulsion tubes to operate twelve times in 0.6 second. There are, then, two types of discharges in strokes which occur in varying degrees—the peaks and the continuing current.

Current Peaks

The attention of lightning protection engineers in the past has been devoted very largely to the study in the field and production in the laboratory of the current peaks of the lightning stroke. In fact, it has only been recently proved† that currents existed of relatively low magnitude flowing for varying lengths of time. The explosive effects of many lightning discharges evidence the existence of steep-fronted waves. The presence of such steep-fronted waves on transmission lines was also deduced from the effects of many lightning waves on apparatus. Such data led very naturally to the conclusion that the dangerous lightning had a steep front and was usually of short duration. The existence of the phenomena of successive discharges in natural lightning had been known for many years, but nothing much was done about it.

Based on meager data of natural lightning, laboratory tests were formulated using a 1.5 by 40 wave, and it has been found in general that apparatus which would withstand the application of such a wave was sufficiently strong to stand up successfully in service. Protective devices were tested to similar standards, based on the effects of waves on transmission lines of the 1.5 x 40 variety. The results here again have been sufficiently successful to indicate that the premise is not too far away from what actually happens in service.

However, certain unexplained troubles developed from time to time which the laboratory tests did not fully explain, and a more exact knowledge of the individual characteristics of lightning seemed neces-

* Multiple Lightning Strokes, K. B. McEachron, December, 1934, *Electrical Engineering*.

† Lightning to the Empire State Building, K. B. McEachron, February, 1939, *Journal* of the Franklin Institute.

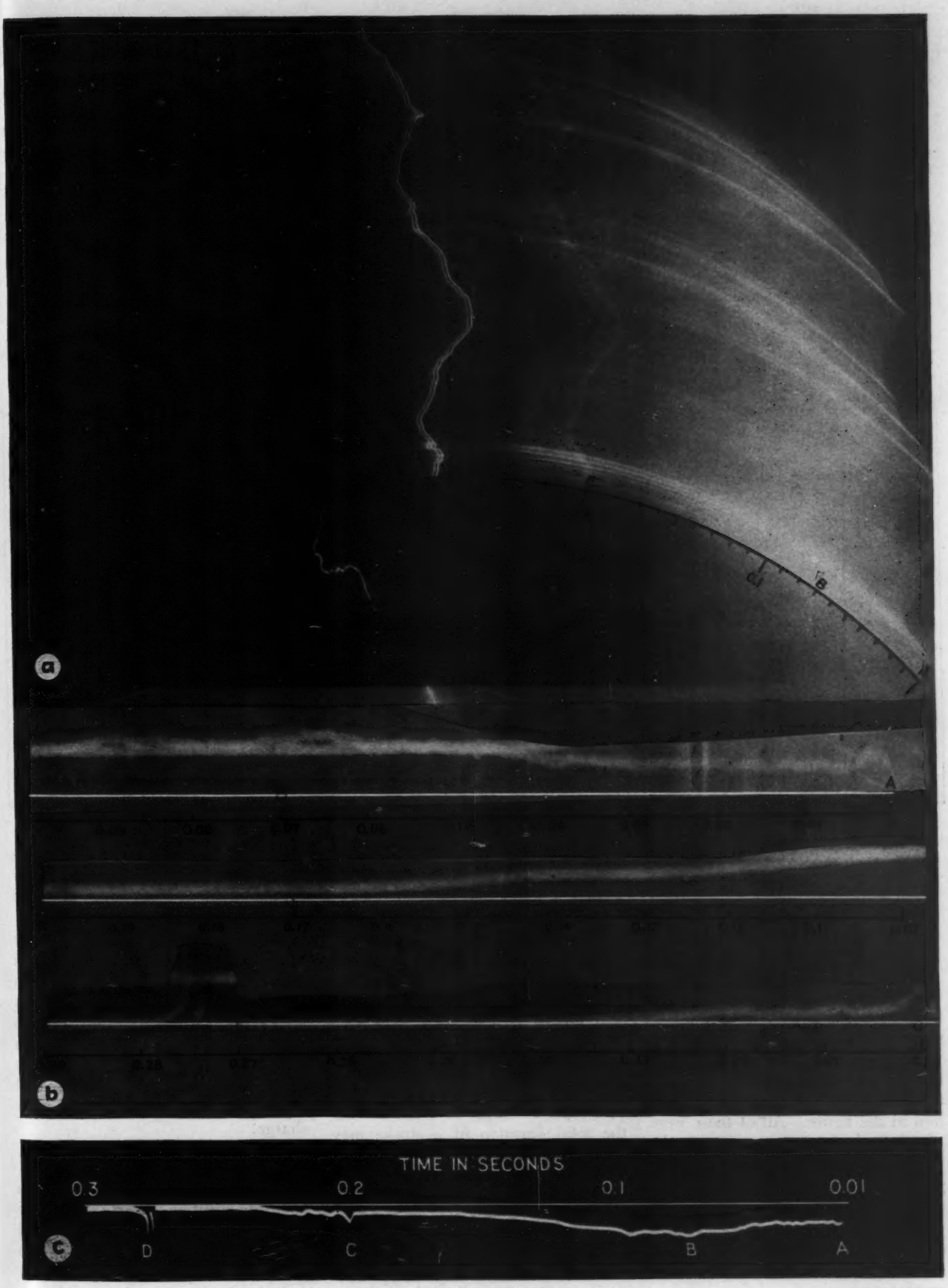


Fig. 1—Relatively long single continuing stroke ends with heavy discharge

(a) Flash photographed by Boys camera on August 11, 1937, at 9:48:30 p.m. from point 2,410 ft. away.
(b) Oscillogram obtained on same stroke at Empire State Building. This is a reproduction of three non-continuous bands of film in lower part of (a). Letters correspond to time scale on (a).

sary. For this reason there was set up in the Empire State Building in 1935 a cathode-ray oscillograph arranged to record not only one current peak but as many as did occur in one second. The equipment, due to its complexity, could not be made to function until the season of 1938, when several oscillograms with successive current peaks were obtained. Some of these oscillograms are reproduced in Fig. 3. The first oscillogram from stroke 18 was a single discharge, while the second and third oscillograms show the wave shape from two successive current peaks 89,200 microseconds apart. The rate of rise, which accelerates as the current becomes higher. This characteristic, which is seen more clearly if the fronts are plotted in rectangular co-ordinates, helps to support the tentative conclusion that low-voltage apparatus should be tested at a slower rate of rise than high-voltage apparatus when making front of wave tests.

Although no slow-speed oscillograms are available for these three strokes shown in Fig. 3, yet all of the data in hand convince the author that a current of low magnitude did flow connecting each of the successive current peaks in the same stroke. charges do not overstress insulation. They may give the appearance of a power burn to stricken conductors or cable sheaths, and in some cases even cause a conductor to part. Compared to the current peaks which may be explosive in their effects, these low-time discharge currents give rise to burning. One blows a tree apart and the other sets fire to it, although both effects may be present as the author has observed.

The slowness of these discharges is the reason for the relatively large charge which may be associated with them. With the current peaks the mobility of charges in the cloud is

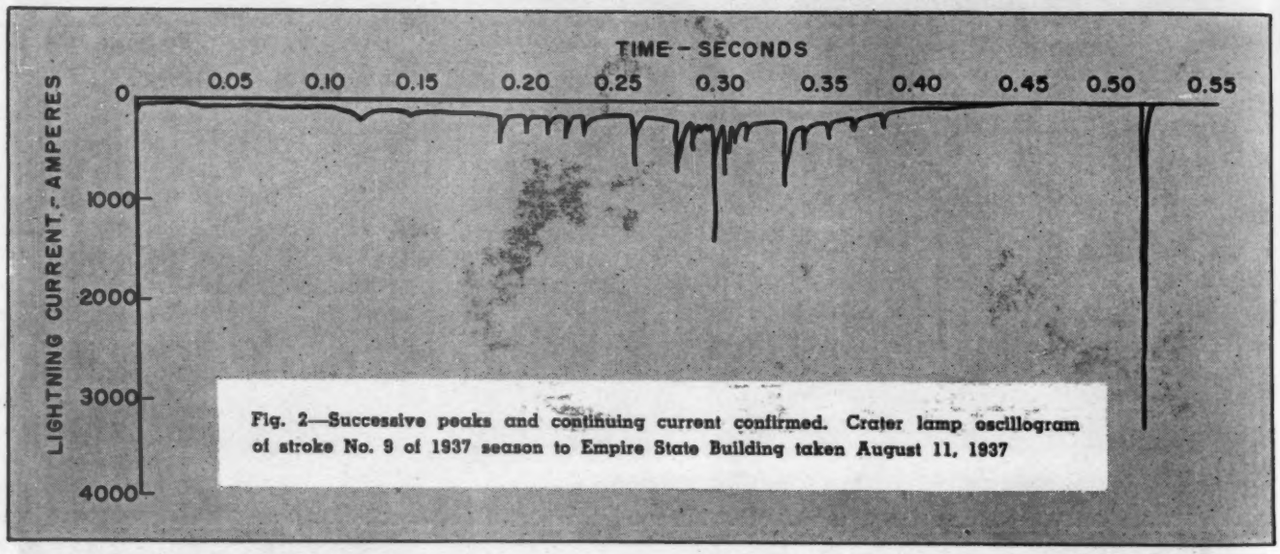


Fig. 2—Successive peaks and continuing current confirmed. Crater lamp oscillogram of stroke No. 9 of 1937 season to Empire State Building taken August 11, 1937

characteristics of these current peaks are as follows:

Stroke No.	Peak No.	Wave Shape	Crest Amperes	Coulombs
18	1	3 x 80*	—14,000	1.02
24	1	5 x 45	—21,000	1.25
	2	6 x 100	—19,000	1.26

* Time in microseconds to half crest current.

In Fig. 3 are also reproduced twelve oscillograms of twelve successive current peaks, all of which were taken in a total time of 0.28 second. The time distribution of the twelve peaks is shown at the bottom of the figure. All of these were of relatively low current magnitude, the second, ninth and twelfth being –5,000, –4,500 and –4,000 amp. respectively. As far as is known, these are the first oscillograms to be taken anywhere showing the detailed wave shape characteristics of successive current peaks.

It is also worthy of note in passing that the wave fronts of all of the peaks on which a good measurement is possible tend to begin with a slower From the data of Lewis and Foust‡ the current in an average lightning stroke is about 24,000 amp., which seems to lead one to believe that the two recorded peaks of stroke 24 are about average. A similar crest current was obtained by Wagner and Beck in 1939¶ using the Fulchronograph.

Low Current Discharges

The studies of lightning to the Empire State Building have shown that the total duration of a stroke may be as long as 1.5 seconds. Other data from other localities show times of the order of one second. It should be understood, however, that these relatively long-time low-current dis-

‡ Lightning Investigation on Transmission Lines-VII, W. W. Lewis and C. M. Foust, 1939 *Electrical Engineering*.

¶ Direct Stroke Proves Length of Lightning Tail, C. F. Wagner and Edward Beck, July 29, 1939, *Electrical World*.

‖ "The Development of the Lightning Discharge," by B. F. J. Schonland, *Transactions* of the South African Institute of Electrical Engineers, Vol. 24, Part 6, June 1933, pages 145-153.

too slow to allow any great volume to discharge, and the result is either a succession of peaks or continued current.

Data compiled from the Empire State investigation, coupled with data from other sources, indicate that, in general, as the crest current in a stroke becomes higher the duration decreases, so that the charge in a single non-continuing high-current stroke will be small indeed compared to the low-current, long-time discharge.

Propagation and Wave Shape

With a negative cloud base an induced positive charge will be found on the earth underneath bound to the cloud charge. Assuming the usual case, in which a stroke begins at the cloud through the stepleader mechanism identified by Schonland,‖ negative charges are let down from the cloud and surround the channel

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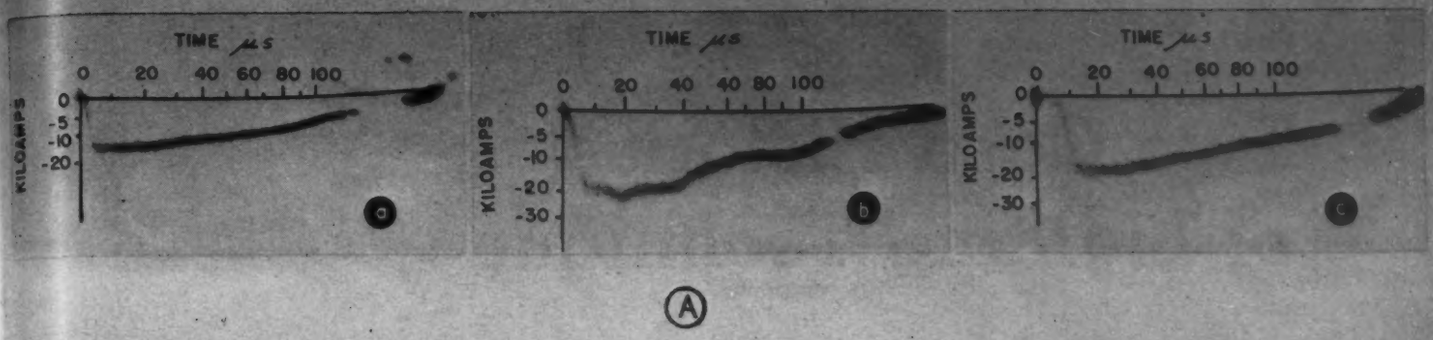

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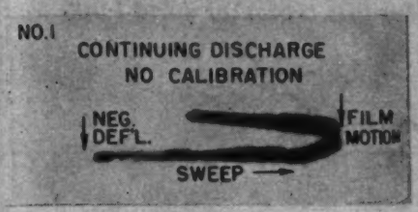

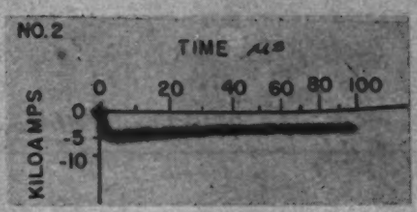

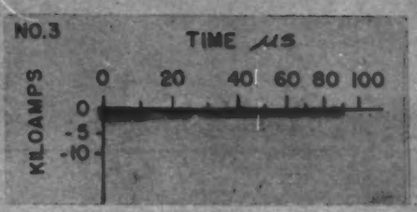

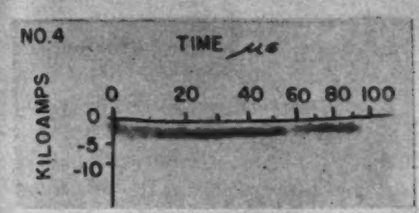

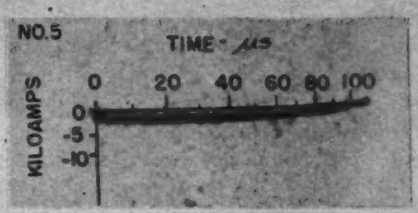

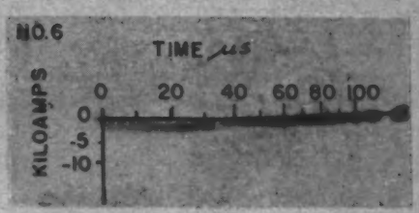

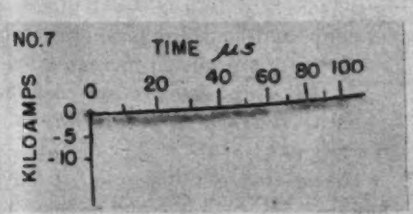

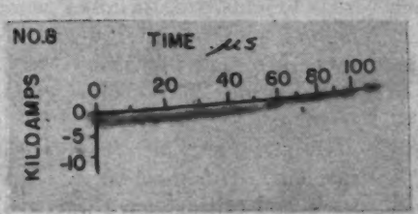

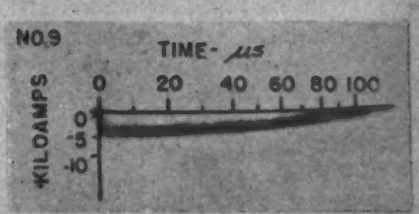

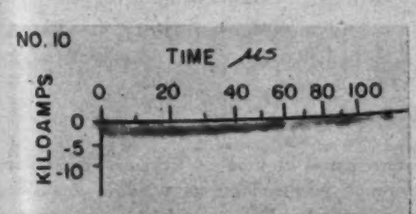

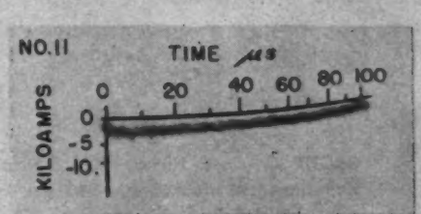

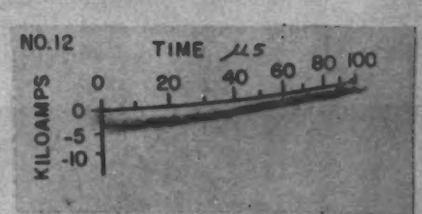

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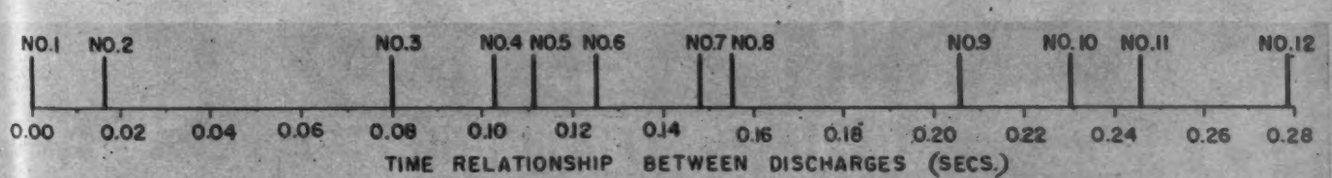
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TIME RELATIONSHIP BETWEEN DISCHARGES (SECS.)

Fig. 3 — Wave shapes and durations of fourteen 1938 strokes disclose repetitive characteristics.

(A) Two afternoon lightning discharges in 1938 — (a) Single discharge stroke No. 18 at 3.03 p.m. on July 11, 1938. (b) (c) Stroke No. 24 (August 8, 1938, at 6.57 p.m.) shows two discharges with 89,200 microseconds between them.

(B) Stroke No. 21 of 1938 (July 20, 1938, at 5:05 a.m.) showed twelve discharges spread over 0.28 second.

Two Case Histories of Lighting Technique

Philadelphia Electric policy on load building through lighting illustrated by two extremes, one for 600 watts, the other for 14,000 watts

J. H. RICH, *Director Retail Sales Promotion, Philadelphia Electric Company*

TYPIFYING the policy of the Philadelphia Electric Company of equal service to all customers, large and small, are two recent cases in relighting. In point of man-hours spent on selling and recommendations each prospect received equal attention. Yet gains from the utility profit standpoint were vastly different.

Case No. 1 was a small neighborhood delicatessen shop. Illumination was decidedly on the "spotty" side, thanks to six 200-watt crystal bottom fixtures inside the store and four of the same type fixtures in the windows. Intensities measured from 5 to 20 ft.-candles in the interior and 50 ft.-candles in the windows. (See Group A and Group B.)

Light conditioning was achieved through three 500-watt semi-indirect fixtures for the store proper. Result—38 ft.-candles throughout the small selling area. And seven 100-watt reflectors tripled the intensity in the windows. The increase in load was only 600 watts, but the company gained a satisfied customer and a booster for our service.

Case No. 2 was a furniture store. Increased business made expansion necessary. With it came complete modernization from structural changes to the latest type lighting installation for both stores and windows.

Open construction windows gave way to enlarged, inclosed windows lighted with twenty 150-watt reflectors. The light intensity was thus raised from 28 ft.-candles to 120. (Group C.)

Overcrowded showrooms became spacious. Light-robbing papered walls and ceilings gave way to light painted surfaces. And distinctly dim illumination was replaced by carefully planned lighting that provides an over-all brilliance—highlighting every piece of merchandise.

Typical of the lighting installation is the first floor. Before relighting this area measured only 7 ft.-candles. Through the installation of ten 500-watt luminous indirect fixtures the intensity was raised to 30 ft.-candles.

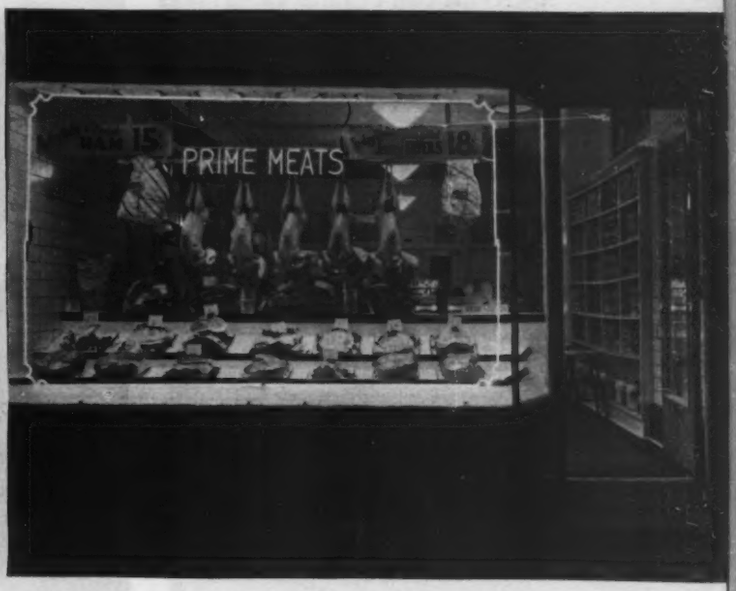
According to the furniture merchants, business increased between 70 and 80 per cent for the first month after modernizing the store.

As previously mentioned, improvements in the delicatessen store lighting brought only a 600-watt increase in connected load. Light conditioning the furniture meant an increased load of 14,000 watts, *but in each case the job was designed to fit best the customer's needs.*

The moral of this tale, if any, might well be that equal service to all types creates sound and good customer relations. At least, such is the case in Philadelphia. And for that reason alone we feel we are on the right track.

GROUP C—Case History No. 2 is a furniture store at time of business expansion. Modernization brought a 70-80 per cent increase in business, as window intensities were raised from 28 ft.-candles to 120 ft.-candles. The furniture store (shown on opposite page at bottom) was also revitalized on the inside by total wattage increase of 14,000 watts. First floor lighting was increased from 7 ft.-candles to 30 ft.-candles

GROUP A—Case History No. 1 is this small neighborhood delicatessen shop. Twelve hundred watts in six crystal-bottom fixtures gave 5 to 20 ft.-candles. To relight this interior the wattage was increased to only 1,500, but foot-candles were increased to 38



GROUP B—The murky window of the neighborhood delicatessen was transformed by tripled intensity from seven new 100-watt reflectors

Ranges and Water Heaters Boost Usage to 1,985 Kw.-Hr.

Year-round efforts of the Washington Water Power Company in major appliance sales and promotion result in 33 per cent range saturation and 23 per cent water heater saturation

R. B. McELROY, *General Sales Manager, Washington Water Power Company, Spokane*

AN AVERAGE of 1,879 kw.-hr. sales per residential customer!

With this record for 1937 some inclination toward a complacent, self-satisfied pat on the back might have seemed justified. Instead, it was accepted as a challenge by the sales organization of the Washington Water Power Company. Sights were raised and effort intensified to the end that in the past year this average residential use was increased to 1,985 kw.-hr.

No small part of this substantial average increase of 106 kw.-hr. can be attributed to the electric range and water heater sales program of the company.

During 1938, 2,256 electric ranges and 1,591 electric water heaters were sold by the company and dealers. Of these unit totals 68 per cent of the range sales and 48 per cent of the water heater sales were by dealers. These sales pushed the saturation in ranges to 33 per cent, an increase of about 2 per cent over 1937, and in water heaters to 23 per cent, likewise a 2 per cent increase over the previous year.

While these sales, saturation and kilowatt-hour figures will be generally recognized as high, it is interesting that despite these figures 65 per cent of the company's customers use less than 650 kw.-hr. per year and 33 per cent use less than 400 kw.-hr. per year.

Analysis of the picture from the revenue viewpoint shows the average annual return per residential customer increased from $42.17 in 1937 to $44.10 in 1938. This viewpoint also shows the average cost per residential kilowatt-hour reduced from 2.24 cents in 1937 to 2.22 cents in 1938.

R. B. McElroy

From still another viewpoint, that of the customer, for an average increase in use of 106 kw.-hr. per year, the customer paid $1.93 more, or only 1.82 cents per kilowatt-hour.

As the backbone of the company's 1938 promotion of electric ranges and water heaters an extensive sales program was conducted from the middle of April into October. The effort was divided into three eight-week sales periods and quotas governed by the number of residential and farm accounts were set for each period for each division and town served. Sales results by periods were as follows:

	Range Sales Company and Dealers	Water Heater Sales Company and Dealers
April 11—June 4.....	579	406
June 13—August 6.....	533	416
August 15—October 8..	514	361
Total	1,626	1,183

The entire effort by the company was pointed toward a truly selective market, those homes already wired for electric cooking but for one reason or another using other cooking fuels, thus adding compensatory business to the lines at a minimum of capital investment.

Advertising for each period was given a distinctive turn, with all media utilized. A "Spook Chaser" campaign, banishing the mistaken idea of the "high cost" of electric cooking, was used during the first period. Advertising for the second period centered about an essay contest on "Why I'd Like to Cook Electrically." The third period utilized testimonial copy on the low cost of electric cooking, sub-meter tests furnishing actual cost figures which were featured in each testimonial.

Throughout the promotion dealers were made an integral part of the campaigns. Display material was furnished without cost to dealers. Entrants in the contest were required to secure entry blanks from dealers or the company. To be eligible these "official entries" then had to be countersigned by the dealer, thus

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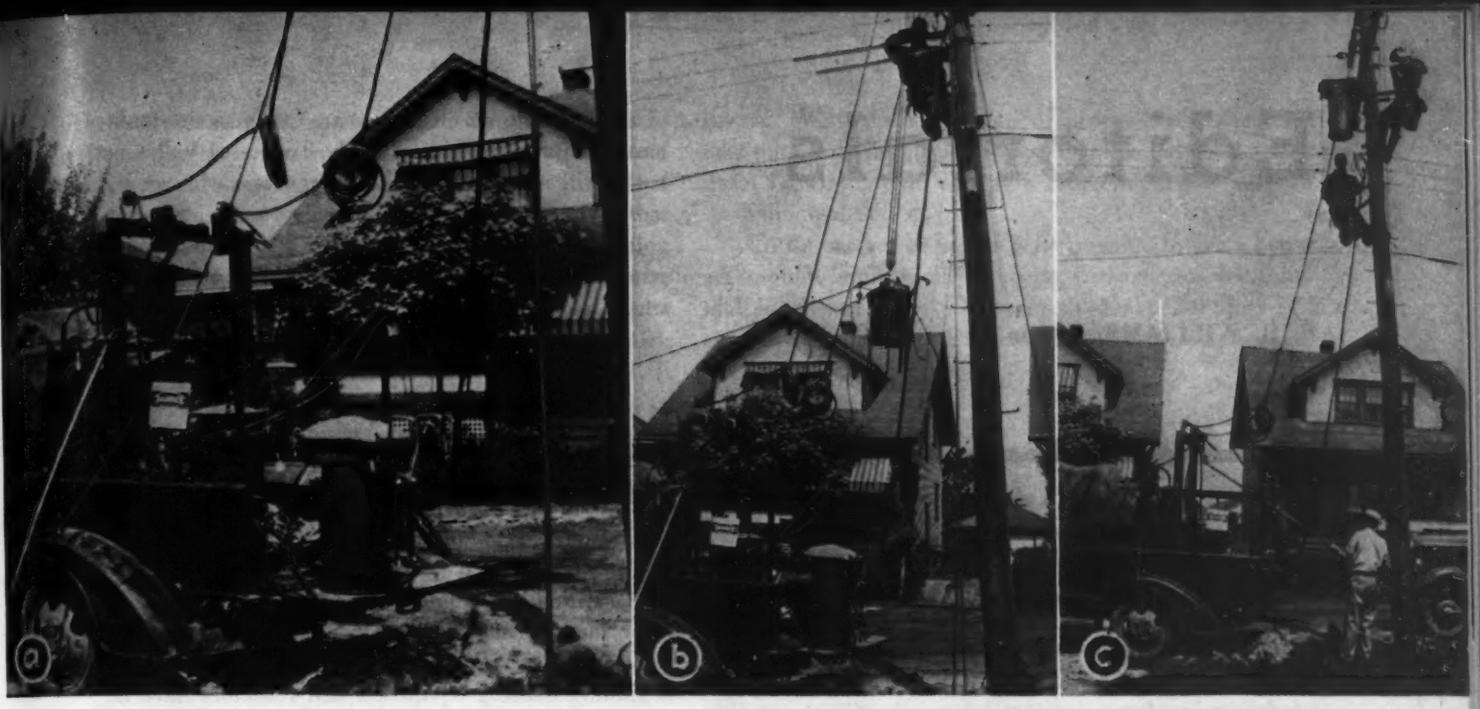

Mobile Transformer Unit Lessens Interruptions

West Penn Power hot-line crew rigs up a 15-kva. transformer with primary and secondary leads to maintain service during construction operations

C. F. SHEAKLEY, *Central Division, West Penn Power Company*

TO MAINTAIN continuous service while either replacing a transformer or doing other construction work necessitating an interruption of service, D. L. Colborn, central division construction superintendent of the West Penn Power Company, designed an economical mobile transformer unit which can be conveniently put into service while the construction changes are being made. The unit is first put in service, then construction started, thus entirely eliminating a service interruption which otherwise would be necessary.

Standard materials are used and so arranged that the unit can be dismantled and the truck made available for other purposes. The supporting structure consists of two vertical and two horizontal members each cut to fit the truck body from 3½ x 4-in. x 8-ft.-0-in., six-pin fir crossarm timbers. The vertical members are 67 in. long and rigidly bolted to the floor of the truck and clamped to the top body guard rail with a flat metal strap and 2½-in. machine bolts. Both horizontal members are fastened to the vertical members with nails for convenience in dismantling. The top horizontal member is fastened to the top of the vertical members and the bottom horizontal member is wedged in between the vertical members. This conserves space and makes the structure more rigid.

The primary leads are 50 ft. long and consist of two No. 4 15,000-volt, rubber-insulated flexible copper cables. One end of each lead is connected to a 50-amp., 7,500-volt primary porcelain box fuse cutout and the other end is fitted with a wire clamp, which can be installed on the line wire with "hot line" tools. A porcelain spool clevis is mounted on top of the upper horizontal mem-

[*Continued on page* 129]

MOBILE TRANSFORMER UNIT in operation. Primary leads are connected to line, thence to 50-amp., 7,500-volt primary porcelain box fuse cutout and thence to transformer on left. Secondaries supported on insulated spool clevis at truck are tied in to overhead secondary system. Transformer on tailboard (a) is to be installed on pole. With service being rendered through mobile transformer, (b) old transformer is disconnected and lowered to ground. New transformer hoisted in position (c) and connected; then temporary transformer is disconnected. Detail of primary side (d), showing leads, fuse cutouts. Lamp on secondaries signals operation.

Editorials

S. B. WILLIAMS, *Editor*

TVA Calls Policy of Taxing Utilities Shortsighted

IMPOSITION of heavy tax loads on utility companies by states and municipalities "is a shortsighted policy." Such words coming from a privately owned utility executive would be considered by politicians and taxing authorities as the raving of an "economic royalist," but when they come from TVA officials they take on new meaning.

Before the House military affairs committee, which is considering the Norris-Sparkman TVA tax adjustment bill, TVA Chief Power Engineer J. A. Krug and Solicitor J. S. Swindler argued against raising the TVA tax bill to reimburse the state and its political subdivisions for taxes lost when the Tennessee Electric Power Company was taken over last August by the TVA and Tennessee municipalities. So acute has this loss of taxes become that some local government officials say that schools may have to close and other welfare activities be curtailed drastically.

Now that there are no privately owned utilities in the valley to "soak" with higher taxes, proposals are being made that TVA should make good. Sensing that if it had to carry an equivalent to utility taxes its electric rate "yardstick" would be jeopardized, TVA states that the utility tax policy followed by Tennessee before statewide municipal ownership "was not one to be considered sound by tax experts." Mr. Krug went even further to say that some of the utility taxes in Tennessee "were punitive."

Short are people's memory, for it was only seven years ago that TVA started its "yardstick" campaign as the spearhead of the attack against private utilities which aroused the nation. More mature thinking is causing the nation to reflect on its past acts and to reconsider the entire power program of the government in the light of present results.

Grant that TVA is a multiple-purpose project and that power activities should not be forced to bear the entire cost. Grant that improvement to navigation and flood control are functions of government. But what of power operations! Should not competitive business be on equal standards and forced to bear equal taxation? If the TVA "yardstick" is to be a true measure of electric rates, should it not contain *all* costs of utility operations without subsidies?

This being an election year, Congress no doubt will pass some measure to placate the Tennessee Valley voters, but it will not fool voters in other states who are paying most of the cost of the socialized project. Some one is going to demand a system of taxation on government power operations which will not subsidize users of electricity at the expense of other taxpayers.

Fluorescent Installation Data Needed

RECENTLY we were criticised for printing a fluorescent lighting picture that was less than half a year old on the grounds that many improvements had been made in the meantime. Perhaps one of the difficulties of fluorescent lighting is that it is improving too fast. From the very beginning housing equipment and reflectors have lagged far behind the illuminant. Until they more nearly catch up customer satisfaction is going to be below par. It costs real money, however, to design and place on the market a new piece of lighting equipment. Manufacturers can hardly be expected to invest large sums in designs that might have a very short life, and that in a market that is yet very small.

Perhaps in the situation as outlined we find the reasons for the lack of practical data on the application of fluorescent lighting. Customers are finding it very difficult to get information that is very convincing on the installation side. Little seems to be known about reflectors or what they will do. It would be unreasonable, of course, to expect as much information on fluorescent as we have on filament lamps, but if customers are to be sold on some other basis than cutting the light bill the utility salesman must have something more than faith to sell with. Some factual data covering mounting heights, spacing, types of reflectors, size of unit, etc., for office buildings are now being collected. Their dissemination will be very helpful to lighting salesmen.

Power Salesmen Want Performance Data

NEMA is giving consideration to a program of industrial electrical modernization. A preliminary study has been made to determine the possibilities and the approach. There appears to be no question about the opportunity. There does, however, appear to be considerable question of the ability of the industry to cash in on such a campaign to the full extent at the present time because of the dearth of performance and application data.

In order to determine what difficulties lie in the path of a national industrial modernization campaign we questionnaired utilities in the major industrial areas. The thing that stood out was the lack of factual data and knowledge about equipments available. Much has been

written concerning the application of certain products in different processes, but very little of a quantitative nature giving actual savings or efficiencies or production improvements. The answer that is always given is that the user does not want his competitor to know.

Fortunately all users are not like that. There are factories where performance data can be had. These should be sought out. If only fifty utilities secured such data each from ten factories in one year they would, if all the information were pooled, have five hundred case studies, which is five hundred more than they now have.

With manufacturers of the electrical equipment to help it shouldn't be difficult to secure five hundred such studies a year. The help that such a portfolio of performance data would give power salesmen would at once become evident, even without a national promotional program. Since the major part of the modernization selling, especially in the smaller plants, must fall on the power salesman, the more he is helped the faster will modernization move forward—and with it equipment, energy and installation sales.

Street Lighting Getting Worse

MORE IS KNOWN about street and highway lighting today than ever before. Equipment is far superior to what it was even a decade ago. Data on relation of lighting to accidents are available. The Junior Chamber of Commerce is behind highway safety lighting. Nevertheless, street lighting appears to be steadily becoming worse.

From a high of 2,330,000,000 kw.-hr. in 1931 the energy consumed in street lighting has, with the exception of 1935, 1936 and 1938, gone down each year until 1939, when it hit 1,830,000,000 kw.-hr., the lowest since 1927. Obviously this means either non-use of certain units or smaller lamps or shorter burning hours, or some combination thereof. In fact, in the last couple of years we have had requests for the moonlight schedules we used to publish years ago.

It is probably true that in more than one place the utility has been content to have the city reduce the street lighting because the city already owed a large and long-standing bill for energy. Some one said recently that the utilities were not pushing street lighting, and the answer was why should they when they aren't getting paid for what they are now supplying?

There is a question, however, whether this seeming economy on the part of cities is not perhaps saving at the spigot and losing at the bung. Data collected in Detroit and elsewhere show definitely that improved street lighting reduces night-driving accidents. Every reported accident costs the citizens money. If these accidents were reduced to the extent they could be through proper street lighting the cities would be money ahead at the end of the year in spite of higher street lighting costs.

Available data show that the utilities have something that they can make the citizens demand—safer streets. With the right kind of promotion it shouldn't take long to build up public sentiment to the point where street lighting would occupy a more important place in the municipal budget.

In the meantime would it be possible to get a better automobile liability and property damage rate for cities that have acceptable street and highway lighting? If experience records determine insurance rates, that might not be such a pipe dream.

Doubling Every Six Years

OLDTIMERS in the electrical business used to point out that the industry doubled in size every five or six years. Today the expectation of any such rate of growth would be regarded as fantastic. We have come to accept the view that here, as in living organisms, biometric law still governs. In the early stages the curve rises sharply, in the later stages it tends to flatten out.

The process may be affected, favorably or unfavorably, by temporary conditions, but the trend continues. The electric light and power industry seems to be at some intermediate point of its cycle; the movement is still strongly upward, but the period of childhood is a thing of the past.

It may come as a surprise, then, to discover that there is a very considerable portion of the industry that is now growing at the youthful rate. A recent estimate by the Edison Electric Institute leads to the conclusion that the group of four leading appliances, in terms of energy consumption—refrigerators, ranges, water heaters and radios—used about 10,300,000,000 kw.-hr. in 1939, or nearly half of the total energy taken by domestic customers. The striking thing is that this is twice the amount in 1933. Moreover, the amount more than doubled in the preceding six-year period.

Merely on a statistical basis, one might conclude that these four appliances or their equivalent, including television, will use nearly as much energy in 1945 as the present total for all domestic use, were it not for the fact that the sales of refrigerators are no longer accelerating, and that a quarter of current sales now replace older units that used more energy. On the other hand, prices have been reduced drastically this year, with the probability that a wider market will be reached so that energy sales from refrigerators should continue to grow substantially, even if not at the former rate.

More, however, can be expected from electric ranges as the result of improved design, better efficiency and price reductions.

The performance of this quartette sustains the judgment of the industry in backing them. Further envisioning the future, however, new devices, not now foreseen or in a developmental stage in some laboratory, will undoubtedly come into the picture and grow at the traditional rate. It would appear that this doubling every five or six years is a law of growth of elements of the electrical industry, in their earlier stages.

Why Right Now?

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

"MR. PRESIDENT, why are you pushing the St. Lawrence Seaway treaty negotiations *now?*"

The speaker was May Craig, correspondent of a string of state of Maine newspapers. The scene was President Roosevelt's office and the occasion his twice-a-week press "conference." There had been some questions and answers relating to the negotiations now proceeding with Dominion officials when May—never afraid to seem impertinent if necessary to get to the heart of a story—put this poser to the Chief Executive.

Apparently the President's first reaction was that this, like so many questions lately, was intended to learn by indirection whether he intended to run for a third term. But he did not tell the questioner not to be so subtle, as he has done so often. He seemed, indeed, nearer at a loss for an answer than he has ever appeared to the newspaper folks.

Finally he resorted to the Irish answer, assuming that Mrs. Craig wondered why he had not pushed the negotiations *sooner*.

Something Peculiar

But there was no real answer to the question. There hasn't been yet. Which is curious, because every one familiar with the seaway situation knows there is *something* peculiar about all the negotiations. The point is that any cub reporter can count noses in the U. S. Senate, if he will take time enough, and find out that the treaty cannot be ratified so long as it contains a seaway.

A little reasoning will explain the Canadian attitude of sudden willingness to meet the President more than half way. It will be recalled that some time subsequent to the defeat by the Senate of the treaty in 1934 Canada proposed to this government that each nation take more power out of Niagara. Secretary of State Hull refused, insisting that the whole boundary waterway situation should be handled in one piece. Obviously the intent of the Roosevelt Administration at that time—and since, for that matter—was to force the Canadian government to go along with the seaway idea in order to get anything else it might want. But let's assume that the staff of the Canadian legation in Washington knows its way around, and hence realizes the Senate situation as to the seaway. Is it inconceivable that Canada might attempt to win Roosevelt's favor by going along with him on the seaway, knowing it could *not* succeed, if in doing so it might then win his approval for something which the Senate might readily grant—more power at Niagara?

Incidentally, that would be in time for *this* war. The seaway power development would furnish no power for this war unless it drags out for more than five years!

So Canada's negotiations can be explained. At least her attitude is so clear to certain senators that they do not wonder about it. But May Craig's question is something else again, whether Mr. Roosevelt intends to retire at the end of his present term or not.

Let's look at this Senate situation. On March 14, 1934, the Senate voted on the seaway treaty, the vote being 46 for it and 42 against. As ratification of a treaty requires a two-thirds vote, it would be necessary for thirteen senators to have changed from "No" to "Aye" to have approved that treaty.

Let's look at the list that voted against it:

Democrats (22) Adams, Col.; Bailey, N. C.; Byrd, Va.; Clark, Mo.; Connally, Texas; Coolidge, Mass.; Copeland, N. Y.; Dieterich, Ill.; George, Ga.; Lewis, Ill.; Lonergan, Conn.; Long, La.; McCarran, Nevada; McGill, Kansas; Neely, W. Va.; Overton, La.; Russell, Ga.; Tydings, Md.; Reynolds, N. C.; Stephens, Miss.; Wagner, N. Y.; Walsh, Mass.

Republicans (20) Austin, Vt.; Barbour, N. J.; Carey, Wyo.; Davis, Pa.; Dickinson, Iowa; Goldsborough, Md.; Hale, Me.; Hastings, Del.; Hatfield, W. Va.; Hebert, R. I.; Kean, N. J.; Keyes, N. H.; McNary, Oregon; Metcalf, R. I.; Patterson, Mo.; Reed, Pa.; Steiwer, Oregon; Townsend, Delaware; Walcott, Conn.; White, Maine.

In addition Senator Glass of Virginia was paired against the treaty, while both Florida senators were absent and not paired. Three other senators were absent and unpaired: Caraway, Arkansas; King, Utah, and Thomas, Oklahoma. These last three do not change the situation, as one would certainly have been against and the other two for, and it takes two pro votes to balance one anti on a vote requiring a two-thirds majority.

No Chance

No one who has studied that vote has been able to figure where the pro-treaty side could gain thirteen votes. There have been lots of changes, but changes in Atlantic Coast states do not count, since the sentiment is so overwhelming against the seaway feature of the treaty, a phase which no concessions by either side, of course, could eliminate, since power and navigation are inseparable in the project.

For instance, Senator Mead, New York, a 100 per cent New Dealer, has replaced Senator Copeland, who wanted Roosevelt defeated in 1936. But Mead has announced that he will vote against *any* form of St. Lawrence seaway. The two Illinois senators (both new since the 1934 vote) have announced that unless Chicago is satisfied on drainage canal diversion they will vote against the treaty. Here conceivably a Canadian concession might win two votes in the Senate. But Roosevelt himself is not in sympathy with this Chicago attitude and has made it abundantly clear that he is not.

One Louisiana senator is new since 1934, but both are against the treaty so long as it contains a seaway. And

[*Continued on page 120*]

NEWS OF THE WEEK

Improvement In Business Seen by N.E.M.A. Members

Electrical manufacturers predict increased profits and expansion in most lines — Association holds midwinter conference in New York — View modernization outlook as bright

Increased profits and general improvement in business were predicted this week by governors of the National Electrical Manufacturers Association, according to Charles E. Swartzbaugh, president of the association.

During the annual midwinter conference at the Waldorf-Astoria in New York this week members of the organization concurred in the findings of the governors and expressed an optimistic outlook for the electrical industry.

Promotional Programs

Manufacturers reported good business for January on all appliances, with the exception of refrigerators. Since the price reduction by leading makers of refrigerators, expectations are for a renewal of buying on a large scale. One of the national promotion programs this year is on electrical refrigerators. The four others include ranges, water heaters, toasters and all-electric kitchens. These five campaigns will be released through the Modern Kitchen Bureau.

The consensus of the replies from NEMA governors was that general business in 1940 will reach higher levels than those of 1939. A continued rise in the durable goods field also is expected, with the electrical manufacturing industry branches following a trend at least equal to that of general business and the durable goods lines. All branches of the industry gave indications of anticipating a good, if not a spectacular, year.

The bright outlook was seen even in the face of a rise in labor costs and price of raw materials. However, it is believed that this will be small. The outlook for profits on the whole is one of expecting an improvement over 1939, but some members feel that profits percentage-wise would be less. On the whole, it is felt that the war in Europe could not help but have an effect upon conditions here, but that business will be good despite this uncertainty.

Mr. Swartzbaugh pointed out that the opinion was that the outlook for industrial modernization appears to be better than that experienced in 1939. The same may be said for utility modernization and expansion. However, it is felt that there is a very real need for expansion and modernization, most particularly modernization of the utilities.

The problem of financing is one still dependent to a considerable degree upon the attitude of government, it was said, but the replies indicate a slightly more optimistic frame of mind in this regard.

At the luncheon on Wednesday Huntington B. Crouse, president of Crouse-Hinds Co., received the James H. McGraw Award Manufacturers Medal "in recognition of his contribution to the advancement of the manufacturing branch of the electrical industry, through his long and influential promotion, by both precept and example, of a broader acceptance of the vital importance of consistent policy in company as well as industry affairs."

A. H. Englund, executive vice-president of Electric Service Supplies Co., Philadelphia, received a 50-year certificate, the only one awarded, in recognition of his continuous service in the electrical industry. Mr. Englund started as a field accountant in 1889 with the Sprague Electric Railway & Motor Co.

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Marshall Succeeds Dow as Detroit Edison Head

Alex Dow, president of Detroit Edison Co. for more than 27 years, retired this week to become chairman of the executive committee. He was succeeded by Alfred C. Marshall, vice-president and general manager for the past seventeen years.

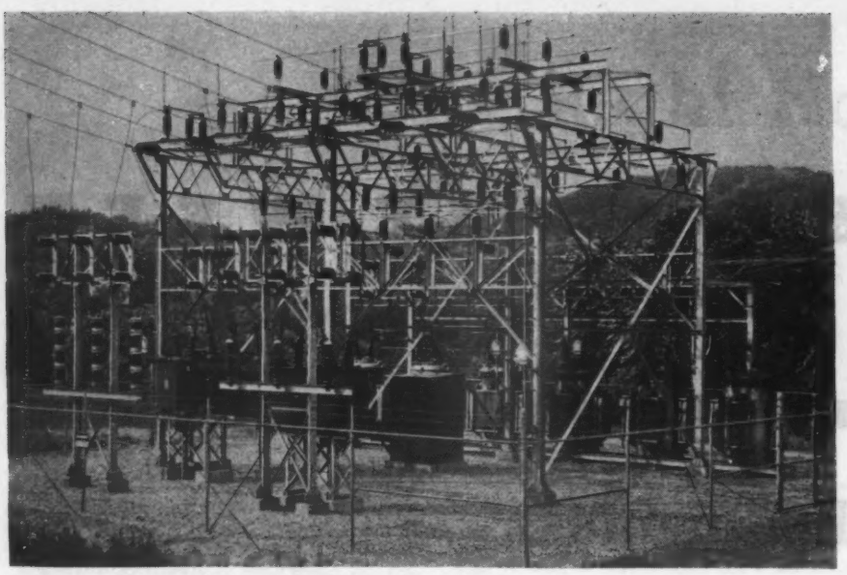
Mr. Dow constructed Detroit's first public lighting plant in 1893 and had picked Mr. Marshall from the graduates of the University of Michigan's Engineering College in that year to assist him in building the Detroit plant.

Seeks Court Review of Duke Power Suit

Greenwood County, South Carolina, has asked the U. S. Supreme Court to review its lawsuit against Duke Power Co. and Southern Public Utilities Co. for damages allegedly resulting from legal delays which blocked its public works hydro-electric program.

The county received an allotment of PWA funds in 1934 for the purpose of constructing a power plant. Duke Power Co. challenged the allotment in the federal courts. In January, 1938, the Supreme Court upheld the allotment of federal money.

The county then sued the company, contending it made substantial profits while the litigation was in process and that the county suffered losses through



SUBSTATION—This 44-kv. substation of Central Vermont Public Service, located in residential area, is equipped throughout with station post type insulators to minimize radio interference. The design provides for a future addition to a 2,300-volt distribution section

engineering expenses, legal fees and loss of profits from the proposed power system. Both the Federal District Court and the Fourth Circuit Court of Appeals denied the county's request for damages.

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Raver Sees Increase in Bonneville Power

Power contracts have been signed for the sale of more than 57,000 kw. of firm power and additional amounts of surplus energy, Dr. Paul J. Raver, Bonneville power administrator, stated in the annual report of the government's power project. Dr. Raver said that other contracts, which will bring the total firm power commitments to over 100,000 kw., are being actively negotiated.

"Those contracts are expected to yield nearly $1,000,000 revenue for the 1940 fiscal year and $2,200,000 for the 1941 fiscal year," Dr. Raver said.

It was revealed that more than fifty inquiries have been received from firms and individuals interested in utilizing Bonneville power in manufacturing operations. The 20-year Aluminum Company of America contract for 32,500 kw. is the largest so far and is expected to return $10,000,000 of revenue over its life.

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Tops Sales Quota

Appliance sales during the "mutual opportunity" campaign, October 1-December 31, of Nebraska Power Co. totaled $1,272,815 during the 90-day period—topping quota. Bigger sales opportunities are seen this year.

Power Bond Issues in Default to U.S.

More than 300 municipal bond issues held by the RFC and PWA have gone "sour" because of failure of the municipalities to meet interest and principal payments, according to a report to the House appropriations committee.

The list includes several power projects which cities, towns and villages eagerly sought during the drive for public ownership. In Nebraska the Loup River power district issued $12,000,000 of bonds to pay for its share of the power program. The bonds are held by either RFC or PWA. Some of the principal has been paid, but not interest; the explanation given is: "Project in development stage."

Similar defaults are listed for Nebraska in connection with the Middle Loup Public Power and Irrigation District and Platte Valley Public Power and Irrigation District. Reasons for the default is that "project is in the development stage."

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Knoxville Lets Contracts

Public Utilities Board, Knoxville, Tenn., has awarded a contract to the Kelso-Wagner Co., Dayton, Ohio, at $121,866, for installation of new equipment in Washington power substation, where expansion will be carried out, and construction of new 13,000-volt overhead transmission lines. Work is covered by two contracts in amounts of $73,918 and $47,948, respectively, for the projects in order noted.

Connecticut Power to Spend $4,000,000

Plant expansion of the Connecticut Power Co. at Stamford, with line and substation improvements on the system, will require about $4,000,000 in new financing this year. An order has been placed with General Electric for a 25,000-kv. steam turbo-alternator to be shipped to Stamford in the spring of 1941, and this unit will require the expenditure of about $3,500,000 at the plant. A new boiler will be installed at this station.

The new turbine unit will be hydrogen-cooled, will operate at 900 deg. F. and on 850-lb. steam. The speed will be 3,600 r.p.m. Stone & Webster Engineering Corp., Boston, is consulting engineer for this development.

Preliminary work is now under way to connect the transmission system of the company from a point near Tariffville to a point near Torrington and about 25 miles of 110-kv. line will be built. The voltage of the Hartford-Agawam 66-kv. line will be raised to 110 kv., and by a connection with the Tariffville construction the existing interconnections of the system will be strengthened materially. The Hartford-Agawam line is already insulated and spaced for 110 kv. The substation at Agawam is connected with the Springfield, Mass., load center and with the Western Massachusetts Companies' lines in the middle Connecticut Valley.

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Consumers Power Pays Fine on Illicit Sales

Fines of $7,000 have been paid in the federal court in Detroit by Consumers Power Co. and two employees for selling gas to illicit distilleries. A jury found the utility guilty on January 19 of "conspiracy" to violate the Federal Internal Revenue Law by knowingly selling its gas to the illegal stills.

The case, first of its kind, has aroused considerable interest for it now becomes binding on the part of the utility to "know to what purpose its customers make use of its services." The utility paid $5,000 and Ralph W. Clark and W. A. Bertke, branch office representatives, $1,000 each.

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New Power Business

Power sales new business of Georgia Power Co. in 1939 totaled 21,680 kw., producing sales of 51,470,000 kw.-hr. and $703,666 in revenue. It was 26.9 per cent over quota.

Modified Requirements Up for Overhead Lines

Technical committee on the National Electrical Safety Code soon to pass on recommendations for revision of strength requirements and storm loading of power lines and crossings

Revision of the National Electrical Safety Code has been under way for more than two years and is now nearing completion. All of the parts, except Part 2 dealing with overhead line construction, have been completed.

A subcommittee on strength requirements and loading has just completed a report to the Technical Committee on Part 2 which will be reviewed at a meeting to be held later this month. Some of the principal recommendations of the subcommittee, whose chairman is W. M. Vandersluis of the Illinois Central Railroad and a representative of the Association of American Railroads, are as follows:

Recommendations

1. The loading map to be changed by shifts in the boundary lines between the three loading districts (see accompanying map).

The loading specification would be changed by assuming a transverse wind pressure of 4 lb. per square foot instead of 8 lb. per square foot in heavy and medium loading districts, and 9 lb. per square foot instead of 12 in the light loading district, with no change in the assumed thickness of ice. In considering the strength of conductors and the longitudinal strength of their supports, however, a constant is added to the resultant loading to bring it back to a value which is equivalent to that produced by an 8-lb. transverse wind.

2. In considering the longitudinal strength of supports no requirements will be made at crossings for lines whose crossing span is of the same construction as the rest of the line, and this applies also at the end of a part of the line involved in a conflict or joint use; but if there is a change in the grade of construction at such point, the longitudinal load is to be determined by assuming two-thirds of the conductors smaller than No. 2 to be broken. This statement applies to power lines, for which the previous assumption has been that all conductors were broken.

3. It is proposed to eliminate the two grades of construction formerly designated as Grade A and Grade B and to substitute a single grade of construction with a new designation. The requirements for transverse strength of this new grade would be the same as old Grade B if unguyed wooden or concrete poles are used. If the poles are guyed, however, the transverse strength for the new grade would be only half that required for old Grade B. If the line were supported by steel towers, however, the strength would depend upon whether the situation formerly called for Grade A or Grade B, the distinction between the two being revived for this purpose.

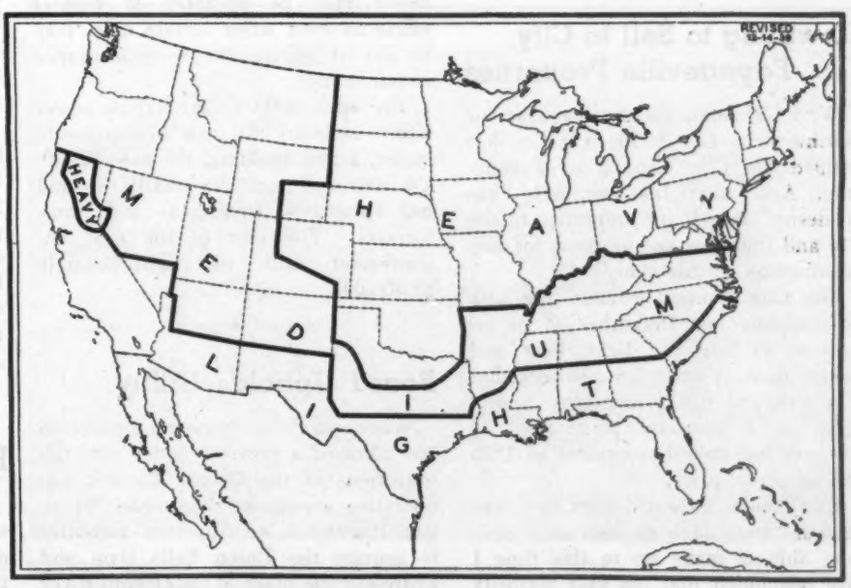
For Grade C construction, using unguyed concrete poles, the required transverse strength would only be three-fourths as much as in the old edition, and for guyed concrete or wood poles the strength would only be half as much. If wood poles are used alone in Grade C construction, the transverse strength at time of installation is reduced one-fourth at crossings, etc., and one-seventh at other locations, and the value of the remaining strength when replacement is called for is reduced one-sixth.

4. Where the longitudinal strength of power lines is obtained by the use of guys, the requirements for the new grade where there is a change in the type of construction at crossings is the same as before except that the assumed number of broken wires has been reduced. At dead ends, however, where the tension in all of the wires must be resisted, the requirements are reduced one-third for the new grade of construction and reduced one-fourth for Grade C.

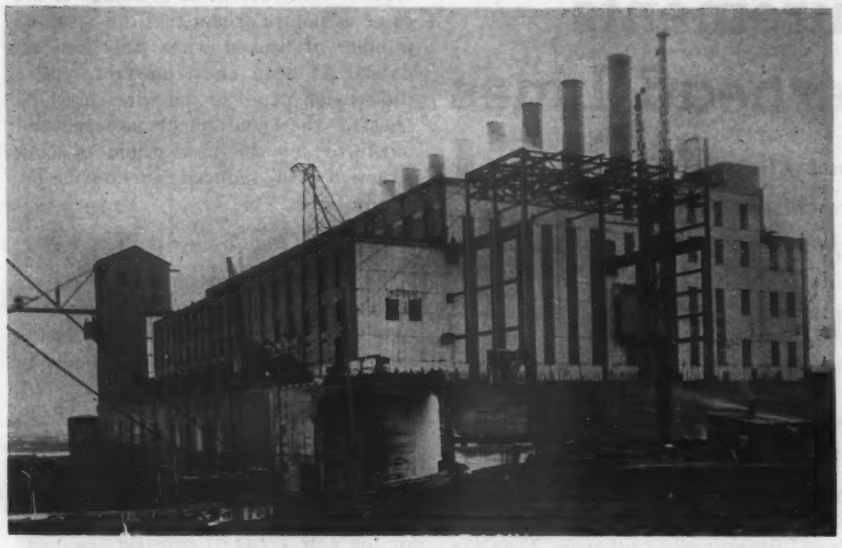
Crossing Requirements Modified

5. As to the crossing of overhead power lines over railroad tracks, the requirements for steel-tower construction have been retained in the main as in the old edition of the code. Since the transverse loading, however, is assumed to be only half as great as before, this will result in the application of working stresses in steel having the value of 10,000 lb. per square inch for the new grade of construction (applying over main railroad tracks, and over major communication lines if the voltage of the power conductors exceeds 2,900 volts to ground); 13,000 lb. per square inch where minor tracks are crossed; and 15,000 lb. per square inch where Grade C is called for. These values apply in heavy loading districts to members which are in tension, there being a reduction for members in compression which involves the well-known relation of the unsupported length of the compression member to the least radius of gyration. Larger unit stresses are permitted as before for longitudinal strength.

6. Although conditions in the three loading districts which affect construction in those districts are supposedly recognized by the three loading specifications, nevertheless it is proposed to use different working stresses in steel



LOADING MAP REVISED—Now includes in medium loading district parts of Maryland, Virginia, North Carolina and New Mexico. Parts of North and South Carolina, New Mexico and Nevada go to light loading. Changes also in California and Texas



MORE POWER—Steel going up on the Toronto station of Ohio Edison Co., where an addition will be built to house a new 400,000-lb.-per-hour Babcock & Wilcox boiler and a Westinghouse condenser and a 35,000-kw. 800-lb., 900 deg. turbo-generator. Four 35,000-kw. units are now in operation in the station

for supporting towers which are located in light loading districts. The working stresses in the above paragraph become 15,000, 19,500, and 22,500 respectively if the steel is erected in light loading territory, although no similar distinctions are made for wood poles, concrete poles, conductors, messengers, or guys.

Other reports have been prepared by the subcommittee on clearances, the subcommittee on line insulators, and the subcommittee on voltages. These will all be reviewed by the technical committee on Part II at a meeting to be held about the end of February.

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Unwilling to Sell to City Fayetteville Properties

W. F. Thomas, district manager for Southwestern Gas & Electric Co., has notified the City Council of Fayetteville, Ark., that his company "has no desire" to sell its properties to the city and that "we see no need for any negotiations at this time."

The City Council advised the utility company last December of its intentions to buy the light, heat and power plant. A state law provides that if a city and utility company cannot agree on a purchase price the city may ask the state Department of Utilities to set a price.

Mr. Thomas informed the City Council that "from such canvass as I have been able to make up to this time I have concluded that the vast majority of the people of Fayetteville is opposed to municipal ownership of our electric properties."

Iowa Utility Orders New 15,000-Kw. Unit

Iowa Electric Light & Power Co. has placed an order with General Electric Co. for a 15,000-kw. extraction-condensing unit to operate at 650 pounds, 750 degrees and 13,800 volts.

The utility points out that a novel feature of the new turbine is that it may be operated as either a straight condensing turbine or steam may be bled at 210 pounds for use in the older turbines in the power house. The reason for this unusual arrangement is to provide the utmost flexibility between units so that the plant as a whole may be operated at highest efficiency even when certain units may be out of service due to maintenance requirements.

The work at the Cedar Rapids power house includes the new high-pressure boiler, a new building, the new 15,000-kw. unit and necessary auxiliaries and bus structures, switchgear and transformers. The cost of the new improvement will be approximately $1,500,000.

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Board Upholds Utility

Wisconsin Public Service Commission has affirmed a previous order over the objections of the Oconto Electric Co-operative giving the Wisconsin Michigan Power Co. of Appleton authority to acquire the Union Falls Dam and hydro-electric plant of the Oconto River Power Co. on the Oconto River. The private utility and the co-operative were competing bidders for the property.

Rural Lines Added by Consumers Power

Continuing its widespread rural electrification program, Consumers Power Co. constructed 2,366 miles of rural line in 1939 and added 9,181 additional Michigan farms to its lines, according to Dan E. Karn, vice-president and general manager.

Mr. Karn said that of the 93,846 farms in the territory in which the company operates 66,511 now get electric service. The area being 71 per cent electrified. Service is also available to an additional 14 per cent of farms along existing lines.

The average number of farms along the company's 17,000 miles of rural lines, Mr. Karn said, is now 3.91 per mile. Some 32,000 non-farm rural customers also are served by the rural lines.

In the last four years Consumers Power has built approximately 12,000 miles of rural lines. At the end of 1935 only 24 per cent of the farms in the company's service area were electrified. In 1935 the average energy use was 751 kw.-hr. and by 1938 it had jumped to 1,169 kw.-hr. and last year the figure was 1,254 kw.-hr., an increase of 7.27 per cent over 1938 and 66 per cent over 1935. The average rate was 3.77 cents in 1935, 3.19 cents in 1938 and 3.09 cents in 1939. Use has increased 66 per cent, while revenue has climbed 36.6 per cent.

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Utility Service Maintained During Birmingham Storm

There were no major troubles of any kind on the electric system of Birmingham Electric Co. during the recent heavy snowfall and severe cold, according to Charles E. Oakes, president.

Mr. Oakes said that all means of transportation were badly crippled and that the zero weather greatly hampered production facilities of many industrial plants, resulting in their partial or complete shutdown for several days. Department stores closed early for several days. Because of the unusual weather conditions, power use showed a decrease for the week.

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Form Anti-Seaway Body

A port of Buffalo defense committee has been formed to consolidate objections of Niagara frontier industry, agriculture and labor to the proposed St. Lawrence seaway and power development. Thomas C. O'Brien, a grain company executive, is chairman.

Plan $2,675,000 Work on Distribution System

Southern California Edison to spend $3,562,000 on new transmission, distribution and substation facilities during year— Appliance sales to net $1,477,440 in E.A.R.

Southern California Edison Co., Ltd., will spend $3,562,000 this year on new transmission, distribution and substation facilities, as compared with $4,000,000 last year, according to Harry J. Bauer, president. Mr. Bauer said that the company will spend $2,675,000 on distribution, the largest item in the budget, against $1,700,000 last year. Transmission expenditures total $47,000, against $800,000, and substations $840,000, against $1,500,000. These expenditures will be financed from current funds, he said.

During 1937 the company began work on the 220-kv. transmission line from Boulder Dam to Chino, one of the system's larger substations about 30 miles east of Los Angeles. This work, including the necessary enlargement at the station, was finished and the company began taking energy on July 1, 1939. Since then, Mr. Bauer said, the 220-kv. transmission has been extended to Barre substation in Orange County (named in honor of the late H. A. Barre, chief engineer). The first line, from Boulder Dam to Chino, is about 233 miles and the extension to Barre about 26 miles. With the completion of this 260-mile project, the company has no major construction program on the calendar at the present time.

Build Rural Lines

Because the urban and rural territory of Southern California Edison is so intermingled the company does not attempt to keep separate statistics for the two types of service. However, in 1939 the company built approximately 200 miles of distribution and it expects to build approximately the same during 1940.

Mr. Bauer said that in the fall of last year negotiations were completed for the transfer of Edison properties to the Los Angeles Bureau of Power and Light in territory annexed to the city from time to time. This included considerable agricultural territory and explains why the company sustained a new loss of 260 rural customers in 1939 and a total net loss of 13,230 meters on the system, inasmuch as 43,704 meters were transferred in this deal. The increase outside of Los Angeles City for the year was 20,474 meters. Net increase in horsepower of connected load for the year was approximately 130,000 hp.

Considerable promotion work has gone forward each year, with the result that average sales of energy have climbed steadily. Last year kilowatthours sold per customer were 5,487, against 4,423 in 1938 and 4,797 in 1937. Domestic sales totaled 997 kw.-hr. in 1939, 946 in 1938 and 910 in 1937.

Accurate figures on dollar volume of appliance sales are difficult at best, but the company reported E.A.R. of $1,493,043 in 1939, $1,472,449 in 1938 and estimates $1,477,440 in 1940.

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Court to Name Trustees for Associated System

Appointment of trustees for Associated Gas & Electric Co. and Associated Gas & Electric Corp. has been deferred until March 8, when Judge Vincent L. Leibell opens hearings in New York. Question uppermost is who and how many trustees will be appointed. SEC privately has said that it does not want the job for a number of reasons. However, SEC is opposed to appointment of any one connected with the system. Probable action is that the court will appoint three co-trustees and two trustees to make up a board of directors.

One of the latest developments in the bankruptcy proceedings under the Chandler Act is that the Department of Justice will investigate the affairs of the Associated System. A Federal Grand Jury investigation will probably be conducted by Hugh A. Fulton, executive Assistant United States Attorney.

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Hydro Unit Completed by Canadian Utility

During 1939 the Churchill River Power Co. completed the addition of a fifth unit of 19,000 hp. to its plant at Island Falls on the Churchill River in Saskatchewan, Canada. The three original 14,000-hp. units in this plant were also rebuilt and converted to 16,500 hp. The fifth unit and the rebuilding of the three other units resulted in an addition to the capacity of the plant of 26,500 hp.

No new water-power development was undertaken in Alberta during the year.

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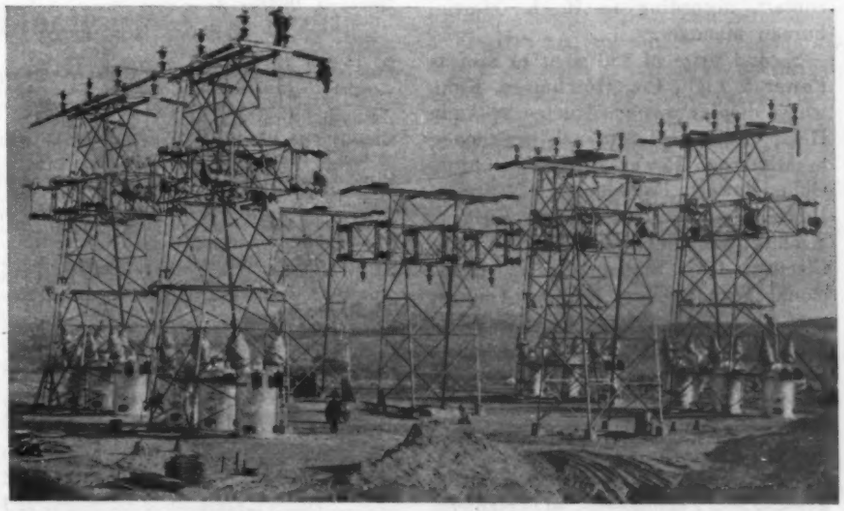
Signs Power Contract

Mississippi Power & Light has signed a contract with the city of Durant to supply power at wholesale. The city estimates substantial savings in purchased power over cost of local generation.



SWITCHYARD—Virtually completed, this switchyard at the Martinez, Calif., steam plant of Pacific Gas & Electric is equipped with oil circuit breakers furnished by Pacific Electric Manufacturing Corp. Ratings are 115 kv., 600 amp., triple pole, 1,000,000 kva. interrupting capacity. Electrical facilities include 25,000 kva. in 115/12-kv. transformers furnished by Westinghouse

PUAA Copy Contest on Regional Basis

The 1940 better copy contest of the Public Utilities Advertising Association is to be conducted along different lines than in the past, according to Thomas H. Spain of Public Service Electric & Gas Co., Newark, N. J. The general purpose of the change is to enhance the value of this nationally famous contest to the public utility industry. The association's better copy contest is generally recognized as the oldest organized advertising competition in existence today.

Mr. Spain said that the 1940 contest, which includes all public utility advertising published in the 1939 year, will be conducted on a regional basis preliminary to the national contest. Each region will select the best advertisements for official certificates of merit. These will later be judged in the national contest. Last year approximately 9,000 individual pieces of copy were submitted for the judges.

It was pointed out by Mr. Spain that the contest is open to all public utility companies—members and non-members of the P.U.A.A. All entries must be in the mail on or before March 15.

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Modern Kitchen Bureau Awards Display Prizes

The unusual window display designed by Harry F. Strong and Ernest Vogt won for the Coshocton, Ohio, office of Ohio Power Co. first honors and a cash award of $100 in the Modern Kitchen Bureau's 1939 national electric water heater window display contest, according to H. L. Martin, bureau manager.

Second prize of $50 went to Kansas Power & Light Co., Hutchinson, Kan., whose display was constructed by Andy Hess. Awards of $10 each were made to Minnesota Power & Light, Duluth; Ohio Power, Portsmouth; Nebraska Power, Omaha; Kansas Gas & Electric, Wichita; Philadelphia Electric; Tampa Electric; Gulf States Utilities, Beaumont, Texas; Ohio Edison, Youngstown, and Northwestern Electric, Portland, Ore.

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Lighting Equipment Group

The American Lighting Equipment Association, composed of eighteen lighting equipment manufacturers, who collectively supply approximately 70 per cent of the country's lighting fixture requirements, was formed last week, climaxing more than a year of organization effort. Program is to revitalize the lighting equipment industry.

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A.I.E.E. Convention

The A.I.E.E. board of directors has approved a recommendation of the Philadelphia Section that the 1941 winter convention be held in Philadelphia. This will be the first time since 1924 that the winter convention has been located outside of New York City. In that year it was held in Philadelphia.

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Correction

The caption under the single picture in the lower center of the page of pictures of the A.I.E.E. winter convention in the February 3 issue of ELECTRICAL WORLD should have read A. Camp Streamer instead of Harry Stephens. Mr. Streamer is general manager of the East Pittsburgh Division of Westinghouse Electric & Manufacturing Co.

MEETINGS

Edison Electric Institute — Electrical equipment committee, Netherlands-Plaza Hotel, Cincinnati, Ohio, February 12-13. Annual sales conference, Edgewater Beach Hotel, Chicago, March 18-21; technical committees. Edgewater Beach Hotel, Chicago, Ill., May 6-9; annual convention, Atlantic City, N. J., June 2-6.

American Institute of Mining and Metallurgical Engineers—Annual meeting, February 12-15, New York, N. Y. A. H. Parsons, secretary, 29 West 39th St., New York, N. Y.

Southeastern Electric Exchange—Engineering and operation section, Robert E. Lee Hotel, Jackson, Miss., February 22-23; annual conference, Hotel Roanoke, Roanoke, Va., May 9-11. J. W. Talley, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

Oklahoma Utilities Association—Annual convention, Biltmore Hotel, Oklahoma City, March 18-19. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City.

Association of Iron and Steel Engineers—Spring engineering conference, Cincinnati, Ohio, April 1-2. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Midwest Power Conference—Palmer House, Chicago, Ill., April 9-10.

Missouri Association of Public Utilities—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 17-19. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Electrochemical Society—Spring meeting, Galen Hall, Wernersville, Pa., April 24-27. Dr. Colin G. Fink, secretary, Columbia University, New York, N. Y.

National Electrical Manufacturers Association—Spring meeting. The Homestead, Hot Springs, Va., May 12-17. W. J. Donald, managing director, 155 East 44th St., New York.

National District Heating Association—Annual meeting, French Lick Springs Hotel, French Lick, Ind., May 14-17. John F. Collins, Jr., secretary-treasurer, 1231 Grant Building, Pittsburgh, Pa.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 19-23. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Pacific Coast Electrical Association—Annual convention, Hotel Oakland, Oakland, Calif., May 22-24. Harold O. Noack, Hubbard & Co., Oakland, convention chairman.

Craig Assails State REA Project Action

Charges by Robert B. Craig, assistant REA administrator, before the House appropriation subcommittee in Washington last week that the ruling of the Massachusetts State Department of Public Utilities against the financing of the REA tri-county electric company is a "horrible example of what ought not to be done" brought little reaction from the department.

The commission rejected in 1937 an allotment of $255,000 for construction of 232 miles of electric lines in Berkshire, Franklin and Hampshire counties on the grounds that it would violate a state law. The proposal called for only $25,000 of capital stock to match $255,000 of federal borrowing. The law provides that stock investment in a utility must at least be equal to its bonded indebtedness.

Refusing to approve the formation of the new company, the commission said that the system apparently consists of twelve separated and disconnected distribution lines. "What is more disturbing is the element of extreme vagueness and uncertainty that surrounds estimates of anticipated revenues and cost of operation of the new company," the commission said. "These unascertained and unknown facts, together with the apparent lack of experienced management, leads to the belief that future financial success is to be left largely in the lap of favorable chance." The commission said it was sympathetic with any program to electrify rural areas, but it could not "shut its eyes to the facts."

Mr. Craig called the action as "wholly indefensible."

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Hartford Hearing Set

Hearing on the status of the Hartford Electric Light & Power Co., which was recessed November 22, will be resumed February 12 in Washington. The issue involves whether the company is a public utility as defined in the Federal Power Act and therefore subject to the jurisdiction of the commission.

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Air-Conditioning Exhibit

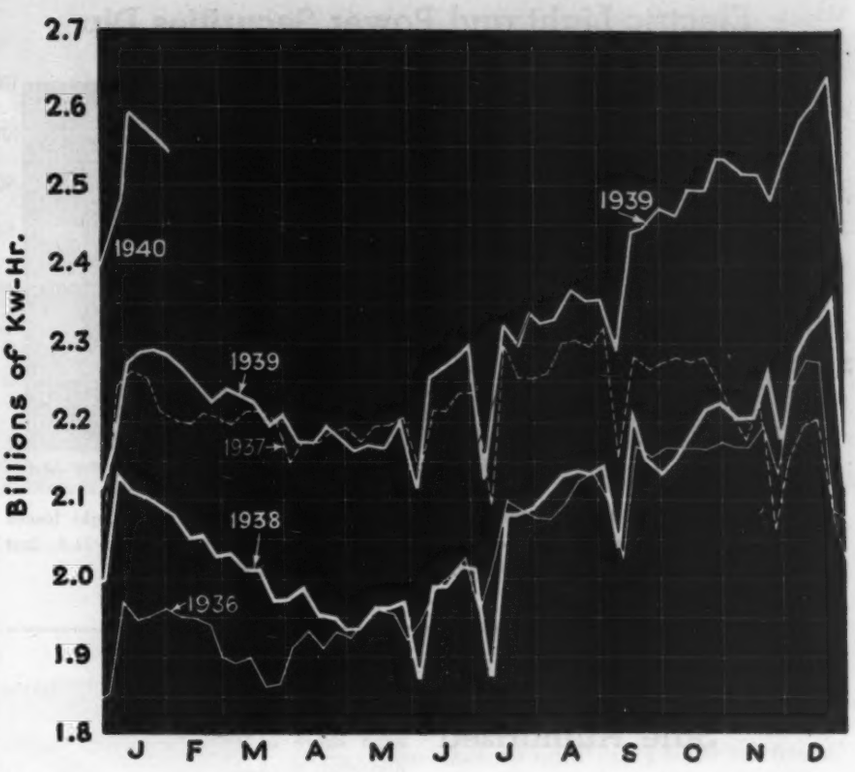
More than 300 leading manufacturers presented displays of the latest air-conditioning equipment and accessories at the sixth International Heating and Ventilating Exposition held recently in Cleveland. Approximately 25,000 persons visited the exposition, the largest of its kind ever held.

Output, 11% Over 1939, Declines Seasonally

With an output of 2,541,358,000 kw.-hr. during the week ended February 3, according to the Edison Electric Institute, operations of the electric light and power industry exceeded those of the like period a year ago by 11.1 per cent. The margin of increase has of late been shrinking somewhat from the maximum of 14.2 per cent in mid-January and now matches that of early December.

Comparison with 1938 is more favorable, gains having held close to 22 per cent in the past three weeks. Over 1937, the previous high year, they have been successively 14.0, 15.8 and 15.4 per cent. It may be said, then, that the gradual decline in output is closely following the seasonal trend of the past three years and is moving almost exactly parallel with 1938, but on a much higher level.

In the regional figures the conspicuous feature continues to be the pronounced rise over 1939 in the Rocky Mountain area, now grown to 22.5 per cent, the largest since early October. The next highest gains, around 14 per cent and therefore well above the national average, occurred in the Central Industrial and Southern regions.



Weekly Output Millions Kw.Hr.

1940		1939		1937*	
Feb. 3	2,541	Feb. 4	2,287	Feb. 6	2,201
Jan. 27	2,546	Jan. 28	2,293	Jan. 30	2,215
Jan. 20	2,572	Jan. 21	2,290	Jan. 23	2,257
Jan. 13	2,593	Jan. 14	2,270	Jan. 16	2,264
Jan. 6	2,473	Jan. 7	2,169	Jan. 9	2,244
1939		1938		Jan. 2	2,069
Dec. 30	2,404	Dec. 31	2,121		

*1937 was high year prior to 1939.

Per Cent Change from Previous Year

	Week Ending		
	Feb. 3	Jan. 27	Jan. 20
New England	+ 8.3	+ 9.0	+10.2
Middle Atlantic	+ 7.0	+ 8.4	+10.1
Central Industrial	+14.5	+14.6	+16.2
West Central	+10.8	+11.7	+10.6
Southern States	+13.9	+14.8	+14.6
Rocky Mountain	+22.5	+21.2	+16.5
Pacific	+ 6.6	+10.3	+ 7.8
United States	+11.1	+11.9	+12.3

Complete Major Concrete Work at Hiwassee Dam

Major concrete work at TVA's Hiwassee Dam has been completed and the gates will be lowered as soon as the waters of the river are no longer needed for power production at the TVA dams on the Tennessee river.

Immediate power installation at Hiwassee will be 60,000 kw. The dam is designed for a second unit of the same size. First power operation at the $17,950,000 project is scheduled for next August.

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Ten PUD's Farm Group

Commissioners of ten public utility districts in Washington State have banded together in the Puget Sound Utility Commissioners' Association, organized to co-ordinate efforts to acquire private power company properties. It was stated that formation of the organization will not bring to an end individual condemnation proceedings. The association is opposed to the recently filed Initiative No. 139, which would require a 50 per cent vote on any revenue bond to be issued by a public utility district.

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Elections to Be Held on Ten Oregon PUDs

Ten separate PUD elections in Oregon are expected to be held on May 17 during the state primary election. These include six proposed districts that are practically county-wide, one embracing the corporate limits of Portland and three small fragments.

The large county districts are Washington, Clackamas, Lincoln, Benton, Coos and Yamhill. The three fragmentary districts are Nehalem Valley, comprising a portion of Clatsop and Columbia counties, the Sand Lake annexation to the existing Tillamook District and the area in the vicinity of Clatskanie in Columbia County.

Proposed districts in Union and Marion counties will probably not be reported on in time to make the primary. These may vote in the November election.

Louisville Seeks to Buy Utility Property in City

A move will be made in the Kentucky Legislature soon by Louisville officials which may ultimately result in the city's ownership of Louisville Gas & Electric Co., subsidiary of Standard Gas & Electric. A bill is to be introduced which will pave the way for the city to purchase the utility property by sale of revenue bonds. The measure has been drafted by Dr. John Bauer, electric rate consultant.

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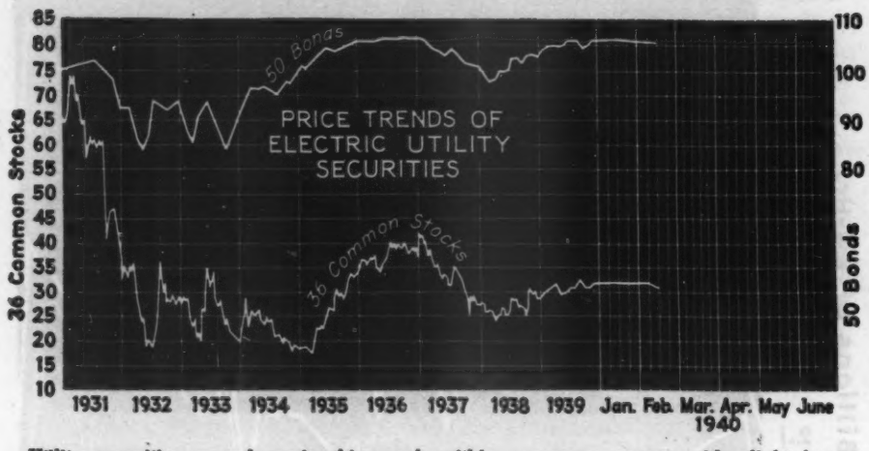
One Hour Peak Doubled

The monthly one hour peak on the Potomac Edison Co. has more than doubled since the low point in early 1933. From the low of slightly under 30,000 kw. in 1933 the system load curve reached a peak in the early fall of 1937 of about 70,000 kw. and then dropped off to under 50,000 kw. before the rise started in 1938. This new rise, with relatively slight movements, carried to a new peak of 70,260 kw. on December 11 between 5 and 6 p.m.

Electric Light and Power Securities Dip



Utility securities moved again this week within a narrow range, with slight losses recorded both in the stock and bond list. "Electrical World" stock index, 31.8, last week, 32.0; last year 30.6. Bond index, 106.0, last week, 106.1

Indianapolis Stock Sale Authorized

Charles T. Adams, trustee for the Utilities Power & Light Corp., has been authorized by Federal Judge William H. Holly of Chicago to proceed with negotiations to dispose of the holding company's stock interest in the Indianapolis Power & Light Corp. Sale of the stock is contemplated to comply with the utility integration clause of the Holding Company Act.

Mr. Adams said he intends to file with the SEC a petition for permission to sell Utilities Power's holdings of all outstanding common stock in the Indianapolis utility. An underwriting agreement has been entered into with a group of investment bankers.

In addition to selling Utilities Power's holdings of 645,980 shares, the underwriting group plans to sell 54,020 shares for the company, proceeds to be used for working capital and other corporate needs.

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G.E. Asks SEC Approval to Buy Utility Stock

General Electric Co., through two of its subsidiaries, Electrical Securities Corp. and G. E. Employees Securities Corp., may acquire 11.02 per cent of the common stock of Community Power & Light Co. as the result of the latter company's capital simplification plan, according to an application filed with the SEC.

General Electric asked for SEC permission to acquire the Community Power & Light stock. The common stock is being distributed to holders of outstanding preferred stock on the basis of five shares of the new common for each share of the first preferred, $6 dividend, stock.

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Plans to Distribute 2,666,667 Shares

North American Light & Power Co. will shortly make offerings of 2,666,667 shares of its common stock to its common-stock holders under an order issued recently by the SEC permitting the issuance of the stock in accordance with decrees of the Federal District Court entered last October 5 pursuant to a decision of the Federal Circuit Court of Appeals in suits brought by certain preferred-stock holders of that company against it and the North American Co.

The offerings will comprise 2,000,000 shares of North American Light & Power Co. common stock ($1 par value) at $1 per share to its common stockholders of record on March 5, 1935, at the rate of 5/9ths of a share for each share held, and 666,667 shares at $3 per share to its common-stock holders of record on March 5, 1936, at the rate of 5/27th of a share for each share held. Holders of record on February 5, 1940, will be entitled to subscribe on the same bases with respect to any excess of their holdings on that date over their holdings on the respective earlier record dates.

The North American Co., which since April, 1934, has owned approximately 73 per cent of North American Light & Power Co. common stock, is waiving its right to take up its pro rata share of the offerings to the extent necessary to permit this participation in the offerings by stockholders of record on February 5, 1940, but under the court decrees it will take up all shares not subscribed for by other stockholders.

•

Plan to Merge Two Units of Middle West Corp.

P. L. Smith, president of Middle West Corp., disclosed this week a projected merger of two Middle West subsidiaries, American Public Service Co. and Central & South Western Utilities Co. He told about the proposed merger while testifying at hearing of the Southwestern Gas & Electric Co., another Middle West unit. Permission for the merger will be asked some time this month.

The combined company would be known as Central and South Western Utilities, Inc., and the merger plan, he said, would "clear up" arrearages on preferred stock of the companies.

•

New Plan Approved by SEC

SEC has approved an amended plan of reorganization for the Mountain States Power Co., according to an announcement by Z. E. Merrill, president of the company. Application was made in the Federal District Court in Wilmington, Del., for an early hearing on confirmation of the amended plan.

The plan provides for the issuance and sale of $7,500,000 of new first mortgage 4¼ per cent bonds and $600,000 of 3 per cent serial notes, proceeds to be used for payment in full of outstanding bonds, with interest 30 days beyond the date of payment.

•

Plans No Financing

Connecticut Light & Power Co. plans no financing in 1940. Sufficient reserves of cash remain out of the last financing in 1938 to take care of requirements for the current year.

Utility Reports

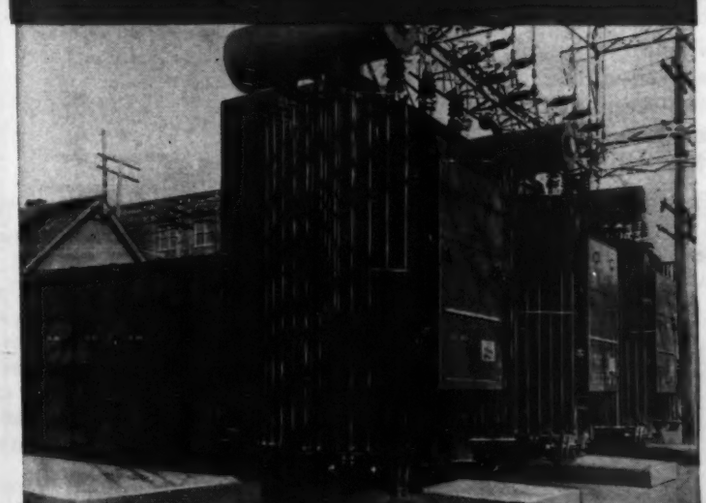
	Net Income 1939	1938
*Coast Counties Gas & Electric	$629,860	$613,949
†Commonwealth & Southern and subs.	13,413,636	10,204,848
†Consolidated Gas Elec. Lt. & Pwr. (Balti.) and sub...	6,805,831	5,853,140
*Duquesne Light	10,271,623	8,826,265
†Louisville Gas & Elec. (Ky.) and subs.	2,790,003	2,582,234
*Mountain States Power Co.	581,747	497,234
†Pacific Lighting	6,886,678	7,896,323
†Southern Colorado Power....	254,666	218,857
†United Gas Improvement and subs	26,635,789	26,053,950

*Twelve months ended November 30.
†Twelve months ended December 31.

See how these large unit substations go into service

1. They arrive—each in two major parts

2. They're set on solid foundations, equipped with accessories, connected . . .



3. And here they are—at work

YES, even the big ones—like these three 6000/8000-kva units for the Indianapolis Power and Light Company—offer advantages in installation. Compared with conventional substations, these factory-built units have far fewer parts requiring field assembly. Consequently, they can be installed in less time and with less work.

Yet ease of installation is but one of several important reasons for specifying unit substations. And any *one* reason might justify their selection.

Besides installation savings, these units offer an important advantage in case the load center changes—they can be moved readily to a new location. Because of their compactness, they require less space, which means savings in real estate, too.

Furthermore, they are neat in appearance—in fact, one power company recently used pictures of actual installations to convince property owners that a proposed installation would be an asset to the neighborhood.

All in all, the unit-substation way is the *modern* way. For that next area to be served, try a G-E unit substation and experience the satisfaction that dozens of users are enjoying. For further information, call the nearest G-E sales office or write General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

310-35

OPERATING PRACTICES

Tie Line Regulator Compensator Setting

By BERTRAM E. ELLSWORTH
Iowa-Nebraska Light & Power Company, Lincoln

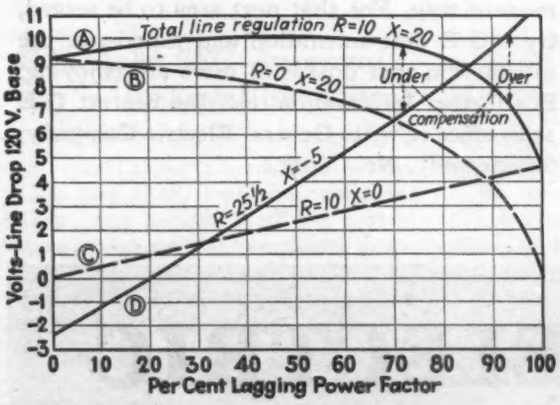
An induction voltage regulator between two plants, where bus voltages are maintained by generator voltage regulators, seemingly does some strange things. Upon close analysis with the aid of vectors, these regulator peculiarities can readily be accounted for.

If the transmission line connecting when the regulator attempts to boost the plant has a high $\frac{R}{X}$ ratio, then when the regulator attempts to boost voltage most of the increase in voltage is used up in forcing increased circulating currents between the plants. The net result of increasing the actual voltage for load purposes is very small. When the resistance of the line is low in comparison to the reactance, these bothersome circulating currents are choked out and more voltage boost is secured in comparison to the line drop.

The correct compensator setting on such a regulator is very essential. This may be illustrated by the accompanying curves. A line is assumed between plants having the regulation shown on curve A. For the regulator to compensate completely for the voltage drop in this line the compensator setting must be $R = 10$ and $X = 20$. The two voltage correction values secured by the reactance and resistance settings are shown respectively by curves B and C.

With the above compensator settings the regulator in an effort to maintain voltage will cause circulating currents to flow and will compensate for them. The regulator cannot distinguish between reactive circulating currents and the reactive current in normal power loads.

It has been found by experience that if the reactance setting of the compensator is reversed, the regulator will tend to keep circulating currents to a minimum. The power factor on the line will then be the power factor of the load. Approximately correct voltage for a given power factor load may be secured at the far end of the line by overcompensating the resistance. The effect is shown by curve D for a theoretical compensator setting of $R = 25\frac{1}{2}$ $X = -5$. For a power factor load of 85 per cent the compensation will be correct.



Reversing reactance setting of regulator reduces circulating currents on interconnections

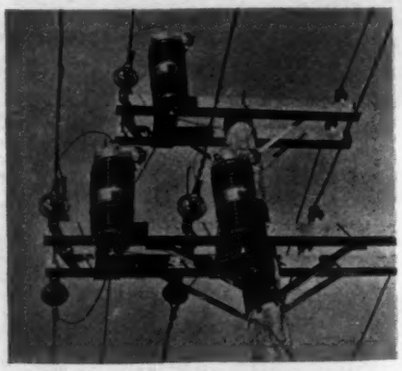
Circulating currents cause increased losses, poor voltage along the line, poor line power factor, resulting in poor stability. Where the load power factor is reasonably constant, the compensator setting, which will reduce circulating currents and is shown by curve D, is to be recommended.

•

Restorers Improve Urban Distribution

By F. H. WILEY
Electric Superintendent,
City of Colorado Springs, Colo.

Application of service restorers to the 6,900-volt urban distribution system of the city of Colorado Springs has proved valuable as a means of promoting good public relations. Reduction of outages, both in duration and number, was the sole reason for using the equipment, and no attempt has been made to justify the expense by computing probable increased revenue.



Installed on the line
In this particular case the circuit with restorers is sometimes used as an emergency main feed to another circuit. Since this load exceeds the capacity of the restorers, open-blade switches are mounted on the arms to shunt them out.

Seven sets of General Electric oil switches have been installed. Each feeder involved covers a rather large portion of the city and is radial,

HERE'S a RECLOSING CUTOUT that SLEET CAN'T BOTHER

QUESTION

When a G-E 2-element, reclosing cutout door gets sleeted shut, does the reclosing element work?

ANSWER

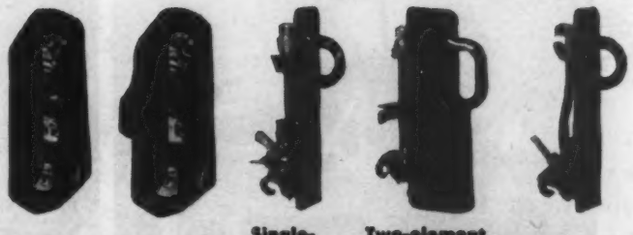
Yes, and it indicates, too.

Let us send you full information on these money-saving combinations. Call your nearest G-E representative or write for supplement to Bulletin GEA-2707, General Electric, Schenectady, New York.

NOT even a heavy coating of ice can interfere with the proper operation of the G-E two-element reclosing cutout. Inside its own special housing, the snugly protected time-delay mechanism can still operate smoothly and promptly. One second after the first fuse blows, the second fuse is connected into the circuit, and the red-flag indicator drops down into view—plainly indicating to the lineman that the cutout has operated and the line has been reclosed. *The door does not have to move in order for the cutout to reclose or to give a good indication.*

And remember, this reclosing door fits all of our 50-ampere indicating and dropout cutouts—just one of the many reasons why we can say: *2 housings and 3 doors will meet 80 per cent of your cutout requirements.* Here's cutout flexibility that spells real savings. You can cut your inventories and still handle 80 per cent of your cutout work with only two housings and three doors. And what's more, our 100-amp, two-housing, three-door line will take care of the other 20 per cent with the same flexibility of application.

2 HOUSINGS AND 3 DOORS



5 Kv | 7.5 Kv | Single-element | Two-element Reclosing | Disconnect

50-Amp Ratings for 80% of Your Requirements
100-Amp Ratings for 20% of Your Requirements
Total 100%

GENERAL ELECTRIC

representing a more or less direct line through the area served, with branches from this line taking care of side areas.

Reclosers were installed in these branches near their junctions with the main feeder. Load charts were taken at these points to determine the switch capacities.

While the period of service is so far rather short, ten operations were registered during August and September without interruptions to the main feeders. Greatest improvement is to be expected in cases where lockouts will occur. In these cases only a fraction of the service from a feeder will be interrupted. Furthermore, outages will be shorter because the area to be patrolled will be much smaller.

The seven installations were made as a trial. Experience has proved satisfactory to the extent that similar installations are planned for other feeders.

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Steerable Trailer Cuts Hauling Costs

By R. L. TAYLOR
Superintendent of Transmission
Nevada-California Electric Corporation,
Riverside, Calif.

Borrowing an idea from the hook-and-ladder fire truck, Nevada-California Electric Corporation was able to reduce the cost of transporting poles through mountains to one-third the former cost by building a steerable trailer, or pole dolly. It greatly facilitates operations on crooked roads and permits the handling of longer poles.

Being experimental, the first unit was made up of such parts as were at hand and hub bolts for the wheels were the only parts purchased. The front end of an old Studebaker—front axle, spindles, hubs, frame and springs—was used for running gear. Steering gear was taken bodily from an old F.W.D. truck and mounted as a complete unit.

The trailer frame was built up of timbers and discarded crossarms, bolted together. The drawbar, mounted so that the frame and axle run backward, is a 5-in. channel, bent into a U, with an old eyebolt welded to the bottom of the U. It is bolted to the fore and aft members of the frame, extending forward of the frame 3½ ft.

Dual wheels must be removed from our four-wheel-drive Ford trucks before they operate in the mountains, so the trailer hubs were designed to accommodate these. The unit was assembled in our own shop, under the direction of Bud Gale, foreman.

Making one 32-mile round trip per day, the unit was used to haul poles over the summit of the White Mountains, elevation 10,500 ft. It carried six 45-ft. poles. These weigh approximately 6,000 lb.

Eighty poles were hauled and the trailer performed without a hitch. The experiment having proved successful, we contemplate rebuilding the trailer for regular use. Heavier parts, particularly the axle, will probably be used. For while the experimental unit was satisfactory, the 6,000-lb. load is fairly heavy for this light equipment, especially on rough roads.

Trailer assembled from old parts. The seat support is galvanized tower steel, bolted together. On roads like this the trailer made it possible to negotiate turns with 45-ft. poles

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Transmission Line Interference Cures—I*

By J. C. FEAR
Northern States Power Co.

Interference on high-voltage transmission lines using pin-type insulators is caused by pin-point discharges from the conductor and tie wire to the insulator, from the steel pin to the socket of the insulator or to the cemented steel block threaded for a steel pin, and among the cemented layers of the built-up insulator. This third cause is a minor prob-

*Adapted from paper presented before Wisconsin Utilities Association.

Control Cables More Accessible in Tunnel

Control cables from the yard at Aetna substation of the Northern Indiana Public Service Company are brought into the station control house from the first manhole in the cable tunnel shown in the accompanying illustration. By laying the low-voltage cable in troughs in a tunnel, rather than putting them in separate ducts, the cables are much more easily accessible than they would be in ducts. In addition, the tunnel, which measures 6 x 6 x 70 ft. long inside, occupies much less space than would be required for the same number of cables in ducts. The sidewalk leading from the control house to the substation yard forms roof of the tunnel.

Ohio Utility Nets $2,200 Yearly on $4,400 Investment

HOW PYRANOL CAPACITORS RELEASED CAPACITY ON A TYPICAL URBAN FEEDER

THE SITUATION

Engineers of the Dayton Power and Light Company faced the problem of low power-factor on several of its 4-kv feeders serving downtown districts in Dayton. Low power-factor—in some cases below 59 per cent—resulted in excessive losses and poor voltage conditions.

PYRANOL CAPACITORS THE SOLUTION

After considering all possible remedies, the utility engineers selected pole-mounted Pyranol capacitors to improve the power-factor.

THE RESULTS

Results exceeded expectations. Actual tests showed that during the morning peak load, power-factor was improved from 59 to 85 per cent, and feeder capacity was increased more than 370 kva. Since the installed cost of the capacitors was $4396, the released feeder capacity was gained at a cost of only $11.78 per kva.

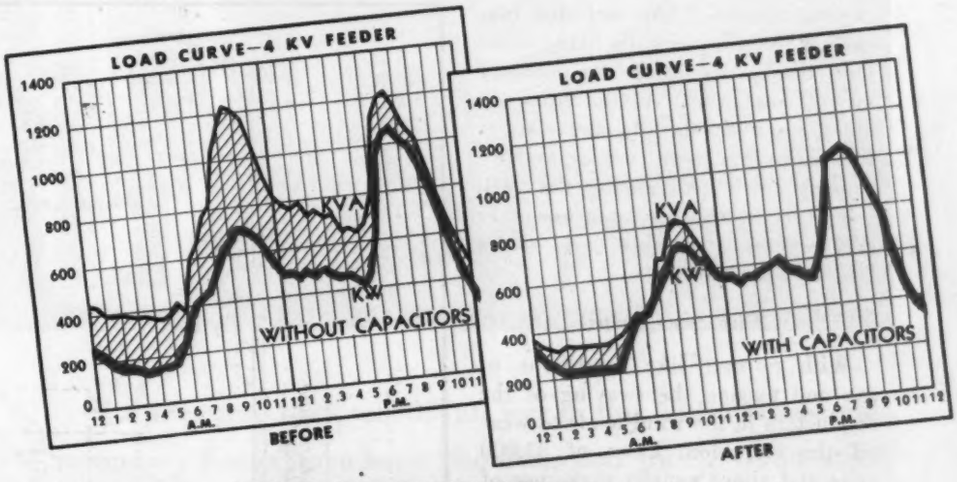
Average line voltage was raised at least one per cent, resulting in improved service as well as an increase of more than 1.4 per cent in annual kw-hr consumption.

Feeder losses were greatly reduced.

THE PROFITS

Direct Savings		
In increased kw-hr consumption	$1417	annually
In decreased copper losses	800	annually
Total	$2217	annually
Indirect Savings		
Released capacity at substation	$ 388*	annually
Released generating capacity	1790*	annually
Total	$2178	annually
Total Investment	$4396	
Annual return from direct savings	50.4%	
Annual return from total savings	99.9%	

*(Obtained by calculating the capacity released by power-factor improvement and evaluating it at the unit cost per kva for each item based on 10% annually fixed charge.)



YOUR OPPORTUNITIES

Somewhere on your system, Pyranol capacitors can do a similar job for you. If your problem is low power-factor, with resultant low level of voltage and excessive losses, Pyranol capacitors are the profitable solution. Call your G-E representative for recommendations or write for Bulletin GEA-2746, "Pyranol Capacitors for Central Station Applications." Address General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

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lem and one which perhaps can be solved by the manufacturer.

To combat the first cause of interference conducting-type paint was applied to the conductor, tie wire and top of the older pin-type insulator and to the fused-on metallic coatings of the new "silent" pin-type, but this increased the charging effect on the steel pin. Conducting-type paint or metal-lined insulator sockets reduced the pin-point discharges at the pinhole. This also distributes the voltage stresses over the entire area of the insulator and reduces the noise level of the line to that generated by the pin-point discharges among the layers of the insulator. These remedies, in some cases, have reduced the noise level as much as 75 per cent, but not entirely, as is sometimes claimed.

Substitution of a wooden pin for the steel pin makes for a marked reduction in line noise, because it eliminates one side of the condenser and oscillatory circuit and thus the spark transmitter is no longer present. It remains for some research laboratory to develop a support for pin-type insulators which will combine the effect of a wooden pin with the strength of a steel one.

On high-voltage, suspension-type insulators the metallic caps and clevises cemented into each disk take care of the pin-point discharge problem; discharges within the insulator are of low order. As the lines get older, however, the pin and clevises which link the units corrode or rust, causing small arcs among the various units in the insulator assembly and increasing the noise level of the line tremendously.

Wire Sway Helps

With normal line conditions of sag and tension the swaying of the conductors in the wind tends to wear off the corrosion. Lines of 33,000 volts and above usually make use of heavy conductors and long spans and this corrects the effects of loose hardware in the insulator assemblies. Cotter keys and pins of these assemblies cause some trouble and under normal conditions tend to raise the noise level of the line. The ball-and-socket type of insulator disk seems to have a lower noise level because of its fewer parts and streamlining and the cotter key is large enough to make a good contact with the other parts of the assembly.

Wooden crossarm braces help some to reduce line noise and take advantage of the wood insulation of the crossarm. Placement of static and ground wires has considerable influence on line noise levels. Ordinary steel staples for attaching ground wires, while a cheap method, tend to become noisy as they rust and loosen in the wood. Wood ground molding or special ground wire clamps seem to be of a more permanent nature and do not increase the noise level as the years go by.

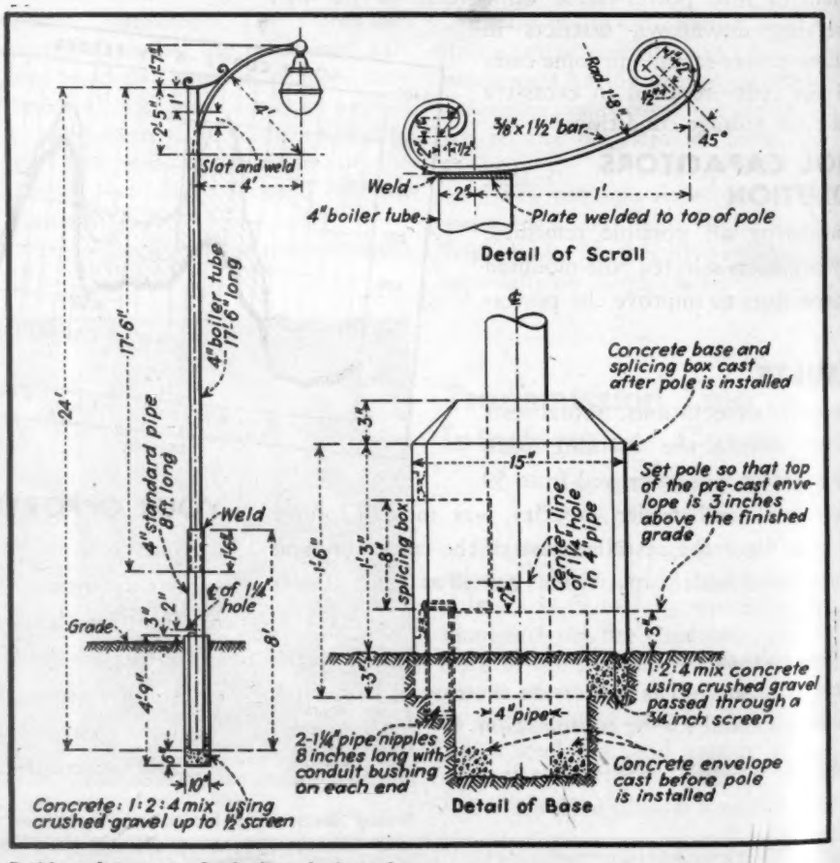
•

Boiler Tubes Become Parkway Fixture

A well-known Southern utility company has evolved a severely plain yet practicable parkway lighting standard which is being built at a very low cost from discarded 4-in. diameter boiler tubes and other low-cost materials. Essential details of the design are shown on the accompanying drawings from the company's files. About 100 fixtures conforming to this design are in use on the system.

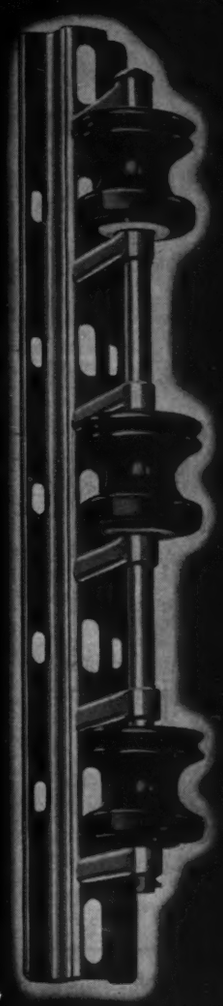
The method of installing the fixtures is of considerable interest. When fabrication of the mast is completed in the shop, and before installation of the fixture, a 10-in. square concrete envelope 4 ft. 6 in. long is cast around its lower end. This envelope protects the in-ground portion of the standard, which is set to a depth such that three inches of the precast envelope project above the finished grade. After the fixture has been set a concrete base 15 x 15 x 18 in. of 1:2:4 mix concrete that extends 3 in. below the finished grade is cast around the standard. This base contains the splice box, which is 6 in. wide, 8 in. high and 5 in. deep, covered with a steel plate bolted flush with the outside of the base. Cable is led into the splice box through two 1¼-in. nipples 8 in. long, fitted with a conduit bushing at either end.

To speed the casting of the concrete envelope around the base of the fixture in the shop the standards are supported horizontally in the center of troughs formed of sheet metal and end spacers and 2 x 10-in. timbers 4 ft. 6 in. long. Concrete is poured into these troughs and around the mast. A number of bases are cast simultaneously with the fixtures lying side by side.


Slot and weld
4'
Weld
4" boiler tube
3/8"x1½" bar
45°
Plate welded to top of pole
Detail of Scroll
4" boiler tube 17'-6" long
4" standard pipe 8 ft. long
Weld
Grade
Concrete base and splicing box cast after pole is installed
Set pole so that top of the pre-cast envelope is 3 inches above the finished grade
15"
splicing box
Center line of 1¼" hole in 4" pipe
4" pipe
1:2:4 mix concrete using crushed gravel passed through a ¾ inch screen
2-1¼" pipe nipples 8 inches long with conduit bushing on each end
Concrete envelope cast before pole is installed
Detail of Base
Concrete: 1:2:4 mix using crushed gravel up to ½" screen

Build parkway standards from boiler tubes

HOLDING THAT LINE



Since way back when

Since way back when Taft was in the White House and Ty Cobb was stealing third, L-M Secondary Racks have been "holding that line". Good steel, good galvanizing, good porcelain . . . these ingredients of every L-M Secondary Rack have proved more than a match for all the strains the years could bring. This staying power of L-M racks is characteristic of all the L-M Pole Line Construction Materials which have "held the line" for utility men through thirty eventful years. You will worry less about sleet and wind, you will save more on lowered maintenance costs wherever L-M Pole Line Construction Materials hold your lines.

LINE MATERIAL CO.

INDUSTRIAL ENGINEERING

Motor-Drive Methods in Average Factory

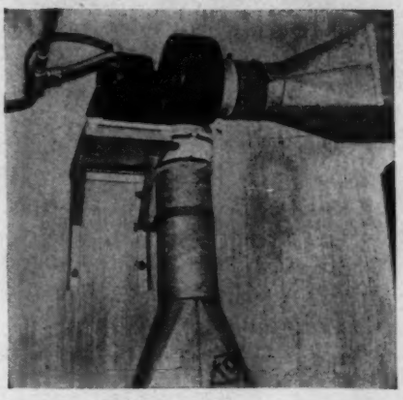
Studies by the Power Transmission Council, Inc., of Boston, over a six-year period, of power factor, efficiency, connected horsepower and installation costs with a "Planned Power Transmission" system and with "Individual Motor Drive" show that, in spite of the variety of industries taken in various sections of the country, the results obtained were approximately the same.

Under installation costs (see table) for both types of transmission are listed costs of motors, controls, wiring, belting, shafting, labor and everything that went into installations. The operating costs show the annual costs of both systems and include power, lubrication, inspection, taxes, insurance, etc. Major replacement items that might be necessary were not included. Under power costs are listed the annual amounts that were paid for electricity and including every energy demand and power factor charges.

The results show that in an average factor with "Planned Power Transmission" the power factor was 84.9 per cent, the efficiency 82.5 per cent, relative connected horsepower required 73.8 and relative installation costs 58.9, while with "'Individual Motor Drive" the power factor was 68.5 per cent, efficiency 76.5 per cent, relative connected horsepower required 100.0 and relative installation costs 100.0.

Thus a factory using a "Planned Power Transmission" system in preference to "'Individual Motor Drive" would have the power factor increased 15 per cent, the efficiency raised 7 per cent, only 74 per cent of the connected horsepower required and the cost of installation but 59 per cent.

Forced Ventilation Stops Fuse Trouble



Inexpensive blower system counteracts high ambient temperatures in control room and stops fuse trouble

One way to lick fuse troubles arising from excessive ambient temperatures in the control room was employed at the Swift soy bean mill near

Resume of Case Study Results

Industry	Connected Horsepower P.P.T.	Unit	Ratio P.P.T./Unit Per Cent	Installation Costs P.P.T.	Unit	Ratio P.P.T./Unit Per Cent	Power Factor Per Cent P.P.T.	Unit	Efficiency, Per Cent P.P.T.	Unit	Annual Operating Costs P.P.T.	Unit	Annual Power Costs P.P.T.	Unit
Metal working	142	258	55.0	$12,496.59	$42,971.86	29.1	85.0	59.0	83.3	74.3	$3,269.08	$9,411.91	$1,350.91	$1,886.15
Machine shop	216	330	65.5	13,269.50	37,958.98	35.1	85.0	64.0	85.0	81.4	5,940.20	11,259.05	3,538.78	4,353.96
Paint and varnish	252	314	80.5	11,644.48	17,400.23	67.0	85.0	74.0	87.1	79.1	1,746.67	2,610.03	4,470.40	5,332.89
Confectionery	1,392	1,610	86.5	105,326.36	180,585.52	58.5	†	†	81.4	75.3	38,745.79	53,233.78	21,013.84	22,715.96
Cotton mill	1,050	1,291	81.3	51,284.11	76,691.09	67.0	88.0	69.0	83.0	78.0	7,692.61	11,503.66	30,653.25	35,945.56
Cotton mill	2,744	3,334	82.5	11,326.01	189,043.62	59.0	87.0	71.0	86.0	75.0	101,224.14	127,361.17	83,156.04	96,222.03
Cotton mill	3,115	3,826	81.5	116,640.00	209,992.60	55.5	82.0	74.0	84.7	81.0	106,264.00	130,167.51	87,020.40	96,015.02
Cotton mill	1,083	1,457	74.5	45,091.97	70,475.51	64.0	87.0	71.0	85 0	75.0	45,223.54	55,226.73	37,788.54	43,680.00
Cotton mill	1,487	1,765	84 2	55,432 15	90,572.00	61.2	85.0	70.0	80.5	74.5	71,516 33	88,109.07	62,348.31	73,046.27
Silk mill	641	717	89 5	42,580 86	65,502.26	65.1	95.0	70.0	84.5	73.4	29,520.53	39,752.20	22,264.91	28,408.36
Gas stove	346	512	67.5	22.442.84	33,351.82	67.5	*95.0	*84.0	72.4	81.5	11,559.13	13,049.77	7,784.00	7,488.00
Steel stampings	248	426	58.3	20,822.35	34,318.48	60.8	80.0	71.0	76.0	71.7	9,684.05	12,292.07	6,193.40	6,574.00
Automobile transmission	891	1,555	75.3	56,105.97	107,703.82	52 2	71.0	49.0	83.7	78.9	15,865.90	25,195.57	6,712.00	7,120.00
Die manufacturing	314	385	81.5	13,920.00	19,496.00	71.5	85.6	64.2	....	....	.....	.....	.....	.....
Laundry	30	48	62.3	1,891.00	5,165.00	36.6	....	....	....	....	.....	.....	.....	.....
Forging	224	348	64.6	4 589.00	7,961.00	67.9	....	....	....	....	.....	.....	.....	.....
Bearing manufacturing	706	791	89.4	38,408.00	45,786.00	83.9	....	....	....	....	.....	.....	.....	.....
Metal stamping	481	772	62.4	27,589.00	48,730.00	56.6	....	....	....	....	.....	.....	.....	.....
Average	844	1,098	73.5	$42,100.00	$71,400.00	58.9	84.9	68.5	82.5	76.8	$34,500.00	$44,600.00	$26,800.00	$30,700.00

P.P.T.—Planned Power Transmission. Unit—Individual Motor Drive. * Using some corrective equipment. † Direct Current—No. P.F.

COPPERWELD OVERHEAD GROUND WIRE

with a life as long as the conductors it protects

string it . .
. . and forget it

The permanent high strength of Copperweld non-rusting overhead ground wire provides safe, efficient, and economical protection — *for the life of the line.*

In Copperweld overhead ground wire (strand) every wire is protected by a thick layer of pure copper* molten-welded to a tough steel core. Since Copperweld is non-rusting, its high strength is permanent, permitting the selection of smaller sizes. Copperweld's high strength, stability, and permanence make it the ideal overhead ground wire.

An interesting new bulletin containing construction methods, wire tables and other valuable engineering data has just been published and a copy is yours for the asking. In writing for it, please mention Bulletin ED 1678.

**Every wire is tested and the thickness of copper is guaranteed.*
(See Copperweld Steel Company's Specification BW-35.)

COPPERWELD STEEL COMPANY

Glassport, Pa.

COPPER · BRONZE · COPPERWELD RODS, WIRE, AND STRAND

Champaign, Ill., recently. In this plant the control room, where the main circuit fuses are located, is completely inclosed and adjacent to a boiler where process steam is generated. Poor ventilation in the control room permitted temperature to build up in the room to a point where fuses operating at normal full load failed periodically. The problem was solved by installing the small blower, shown, that draws air from outdoors and discharges it at floor level through a renewable filter. Air is exhausted from the room through a small automatic ventilating louver near the ceiling. Since the system was installed no further trouble has been experienced.

•

BTA Motor Best for Gravure Press

Comparison of the BTA type a.c. adjustable-speed brush-shifting motor with a d.c. motor and motor-generator set combination for driving two new two-unit gravure presses at the Chicago Rotoprint Company found the advantage with the a.c. motor largely on the grounds of efficiency. Costing roughly the same as a d.c. motor and m.g. set combination, the BTA double-motor drive for the presses had an over-all efficiency of 82 per cent over a large portion of its working range. Contrasted with this the m.g. set efficiency alone was 82-85 per cent. This, when considered with a d.c. motor efficiency of 80-82 per cent, gave the entire system an over-all efficiency of 65-70 per cent.

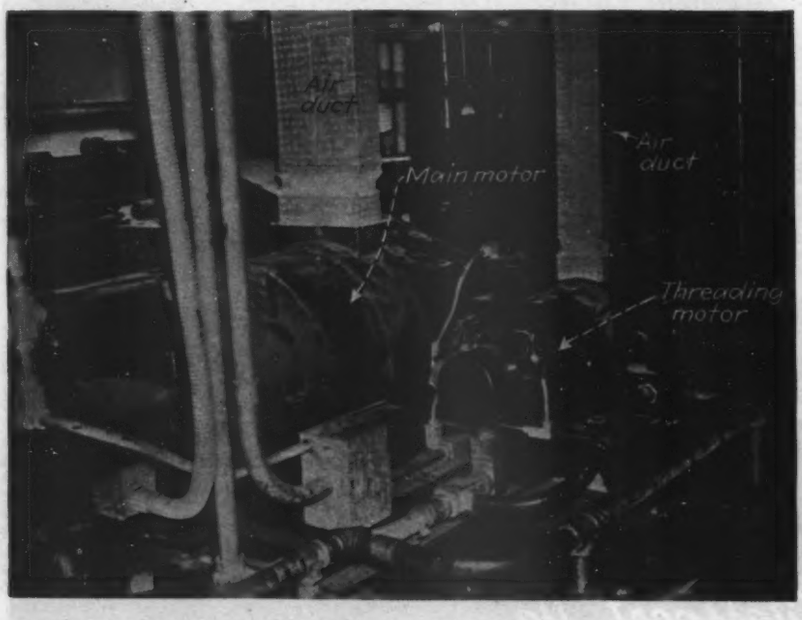
The new presses to be used for printing catalogs and advertising folders were designed for constant paper (web) speed of 800 ft. per minute, using several roll sizes varying from 33 to 55 in. in circumference, depending on the size of the form being printed. (A plant printing newspaper supplements uses only one size cylinder because of the fixed sheet size.) Neglecting friction and windage, the horsepower required to drive such a press operating at constant web speed with different size cylinders is constant. However, in a press operating over a range of web speeds with but one cylinder size torque required is constant and horsepower increases directly with the speed. Therefore, in selecting the proper size motor for this or any similar installation, it is only necessary to determine the horsepower required to drive the largest cylinder to be used (55 in. circumference) at the cylinder speed (10,500 r.p.h.) necessary to give the 800 ft. per minute web speed. The motor selected, as shown in the accompanying curve, will then have ample horsepower to drive the smaller cylinders at the higher speeds.

In the case of the Chicago Rotoprint Company's presses main drive a BTA motor with a 3:1 speed range and capable of developing 40 hp. over the range from 1,000—630 r.p.m. and 21.2 hp. at its minimum speed of 333 r.p.m. was selected. A double motor drive was evolved for the press with a 15-hp. threading-starting motor connected to the main drive through an over-running clutch which automatically cuts out as base speed (333 r.p.m.) of the main 40-hp. motor is attained.

Because of the presence of volatile inks containing benzol, both the main and threading motors are "separately forced ventilated motors." Air from an outside source is forced to the motors through a duct by a separately operated blower. Air in the drive motors is under pressure, thus excluding hazardous vapors.

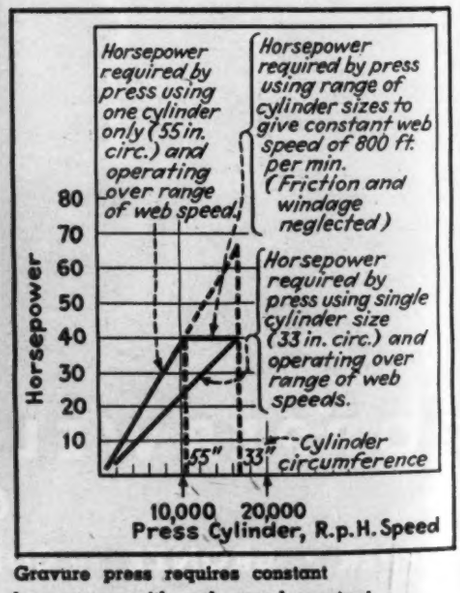
Motor speed is remotely controlled from eight explosion-proof push-button stations on each press which operate through a control panel located in a remote section of the press-room where the hazardous conditions are not severe. This panel contains incoming 220-volt supply lines, controls for main and threading motors giving overload and under-voltage protection and providing the threading-start motor with an adjustable dial for threading speed control. For parallel operation of the two presses Selsyn motors operate the brush-shifting mechanisms to keep the motors in synchronism to secure the same operation from both the threading and main drive motors.

Motor and control equipment for this installation were supplied by the General Electric Company.



Use BTA motor for gravure press drive

Double-motor drive using constant torque brush-shifting motor, specially ventilated to exclude explosive gas, used for gravure press. High efficiency over entire speed range a determining consideration.


Horsepower required by press using one cylinder only (55 in. circ.) and operating over range of web speed.
Horsepower required by press using range of cylinder sizes to give constant web speed of 800 ft. per min. (Friction and windage neglected)
Horsepower required by press using single cylinder size (33 in. circ.) and operating over range of web speeds.
Horsepower
80
70
60
50
40
30
20
10
55"
33"
Cylinder circumference
10,000
20,000
Press Cylinder, R.p.H. Speed

Gravure press requires constant horsepower with web speed constant

NEW ENGINEERING IDEAS

New Tubes Simplify Carrier Power Supply

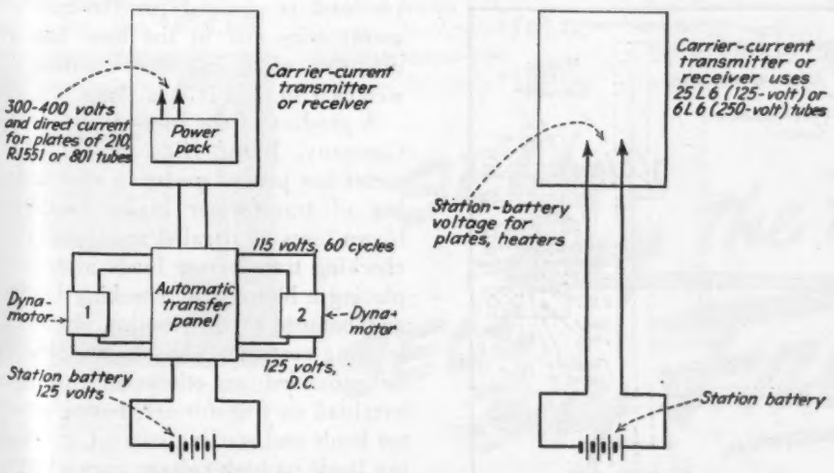
By R. M. SMITH
Relay Engineer Westinghouse Electric & Manufacturing Company, Newark, N. J.

The advent of electronic tubes capable of delivering higher outputs at plate voltages of 125 and 250 makes possible a more compact carrier-current transmitter and receiver. It permits a carrier-current relaying system without rotating parts and hence with virtually no maintenance and greater reliability, as well as simpler installation and adjustment of the equipment for service operations.

Obviousy an absolutely reliable source of power is necessary for carrier-current relaying. Since the a.c. voltage of the station bus may be low because of the presence of a nearby fault, it has become common practice to draw power for the carrier from the station storage battery, which is generally 125 volts and sometimes 250 volts.

The carrier sets require 115 volts at 60 cycles. To provide this from the station battery an inverter or dynamotor generally has been used, which means the insertion of a piece of rotating apparatus into the system. Because of the need for absolute reliability it has been common practice to use a spare dynamotor and a transfer panel for connecting it automatically should the regular one be inoperative. This added appreciably to the complexity of the carrier power-supply system.

Radio tubes capable of delivering adequate amounts of power have required plate voltages of 300 to 400. However, tubes with higher outputs that operate from 125 to 250 volts d.c. have become available. Use of these tubes obviates the need for the two dynamotors, the transfer panel and a large proportion of the power pack, resulting in the simpler system illustrated.



Radio tubes operating directly from station battery simplify carrier-current system
New tubes operating at plate voltages of 125 and 250 d.c. simplify carrier-current relaying system (right) in which dynamotors, transfer panel and part of power pack formerly required (left) are eliminated.

Provides Instant A. C. Standby

Radio transmitting stations cannot tolerate more than a momentary interruption of power source, because transmitting tubes quickly lose heat and a transmission outage of much greater duration than the actual power outage results. Hence, where radio transmitters operate from a power source which is susceptible to interruption, a stand-by source of a.c. power which can be brought into service instantly is essential.

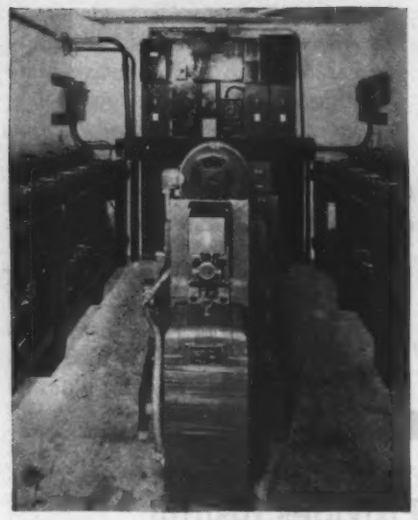
Such a stand-by system was developed in San Francisco this year to serve broadcasting studios at the San Francisco Fair. High-order reliability was not considered economical in serving the fair grounds, so these stations were liable to interruptions.

Economy was introduced in the stand-by scheme by separating the load into one part which had to be served a.c., and into a second part—lighting, etc.—which could, in emergency, be served d.c. This minimized required machine capacities, and a second economy was effected by using a d.c. machine as both a motor and a generator.

Loads involved are 10 kva. a.c. and 15 kw. d.c. The equipment consists essentially of three machines, which rotate together, and batteries.

The system operates as follows: When a.c. power is available, a 10-hp. a.c. motor does the driving. Through a V-belt, it turns a 15-hp. d.c. motor-generator at 2,200 r.p.m. At this speed terminal voltage of the motor-generator is higher than the voltage of the batteries across which it is connected and batteries are continuously floated—at 2.15 volts per cell.

When voltage in the normal a.c.



Equipment is compact, battery banks at left and right, machines at center; a.-c. motor is above, d.c. generator-motor and a.c. generator on the same shaft below

supply lines falls, holding coils are released. This causes the d.c. load to be switched onto the batteries and the a.c. load to be switched onto the a.c. generator.

The a.c. motor—power source being lost—is no longer driving. The a.c. generator, to which the a.c. portion of the load has been transferred, acts as an induction brake, and speed of the system is instantly reduced to 1,800 r.p.m. At this speed the voltage of the d.c. motor-generator has dropped below that of the batteries, and it operates in the same direction as a motor, driving the a.c. generator. The entire transfer takes place in the fraction of a second and is not apparent to the customer.

The system is so designed that at 1,800 r.p.m. the generator is supplying regulated voltage at proper frequency. A rheostat, operated manually at the control panel, is in series with the d.c. motor-generator field. It regulates the floating voltage on charge and the speed (hence frequency) on discharge to compensate for falling voltage in the batteries.

Meters for frequency and for d.c. volts and current are also mounted on the panel, which can be situated remotely from the rest of the equipment.

Exide sealed-glass-jar batteries are employed, arranged in four banks of 60 cells each, two banks in series, and the two pairs in multiple. Battery capacity is 30.9 kw.-hr. The units are capable of delivering 25 kw. for one hour.

Aside from instantaneous availability, the system has the advantages of occupying small space, introducing no fire hazard and requiring only normal ventilation. Batteries, representing 30 per cent of the total cost, have an eight- to twelve-year life, while other equipment should give service for at least twenty years, thus making annual depreciation small.

Under supervision of L. Hewitt, consulting engineer, the stand-by system was designed and furnished by ES-B-ES Company, Ltd., San Francisco, which has a patent pending on the scheme.

•

Meter Protector

Through an error, the accuracy of the M. & W. Electric Manufacturing Company watt-hour meter protective device after surge tests was incorrectly given in ELECTRICAL WORLD, January 13, 1940, page 130. Revolution of standard meter before tests was 10.62-0.62; after, 10.56-0.55, or plus 0.52 per cent change in revolution, instead of 9.52.

•

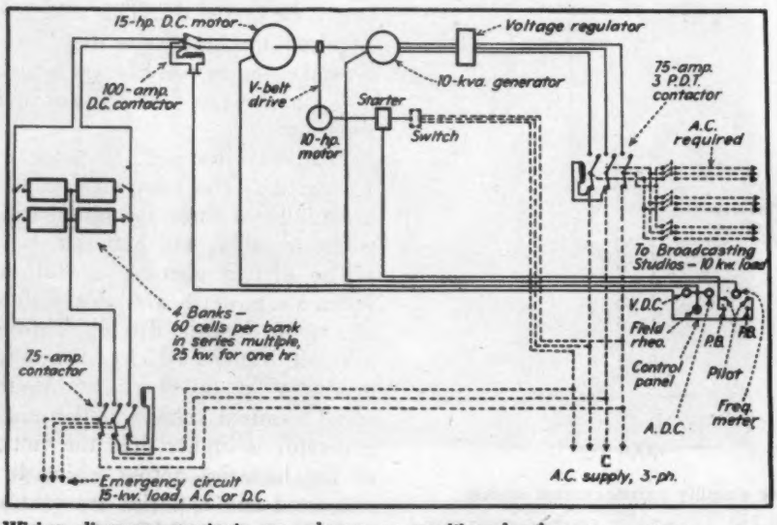
New Ammeter Speeds Distribution Studies

To facilitate the making of distribution load studies a recently announced meter measures the current in a conductor when set or rested against it, thus permitting more readings to be taken on the loads of transformers, regulators, feeders and customers.

The ammeter consists of two coils or inductors so placed within the molded base of the instrument that when the instrument is placed on a current-carrying conductor a voltage is induced in the coils that is proportional to the current in the conductor. This voltage is rectified and indicated by a voltmeter whose scale is marked in amperes.

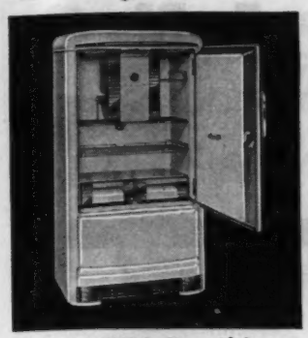
Normally, the instrument is supplied with a dual scale of 0/50/250 amp. When it is desirable to use the 50-amp. scale a push button on the side of the instrument is pressed with the finger; the instrument may be locked on this scale by pressing the push button and turning it slightly to the right. This push button is knurled on the end so that a lineman can change the range while up a pole by pressing the button against the pole and giving the instrument a slight twist. An accuracy of better than 5 per cent is claimed for the instrument; wire slot in the base has a diameter of $\frac{3}{4}$ in.; the instrument weighs 1 lb. and is 3 in. long.

A product of the Jones Instrument Company, Burnt Hills, N. Y., the meter has proved useful in spot testing of transformer loads, locating blown fuses on parallel transformers, checking transformer loads after replacing a blown fuse, checking loads and balance of distribution circuits, locating customer whose service may be grounded or otherwise causing overload on transformer, testing motor loads and starting current, checking loads on high-voltage lines where no current transformers are installed and conventional methods of inspection are not safe.



Wiring diagram—contacts are shown as positioned when a.c. source is energized; dotted lines show normal a.c. circuits

Compare these cabinets with any other line — Bar None!



DE LUXE MODELS. Beautiful new cabinet design. Stainless Chromium shelves. Double-Easy Quickube Trays. Large Meat-Tender. Sliding Glass-Topped Hydrators. 1-Piece Steel Cabinet. Meter-Miser mechanism. F-114 refrigerant. Dulux finish. Many more.

De luxe 5-40.
New Low Price Only **$172.00***

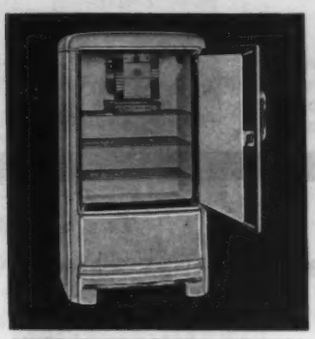
De luxe 6-40.
New Low Price Only **$187.00***

MASTER MODELS. Beautiful cabinet design. Chromium shelves. Quickube Trays. Cold Storage Tray. Glass-Topped Hydrator. 1-Piece Steel Cabinet. Dulux finish. Meter-Miser. Many more.

Master 5-40.
New Low Price Only **$147.50***

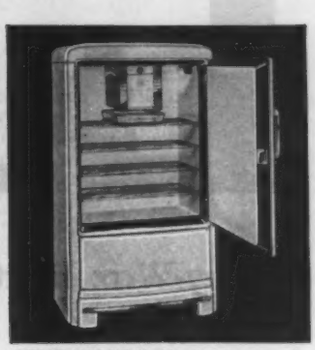
Master 6-40.
New Low Price Only **$157.50***

Master 8-40.
New Low Price Only **$196.50***



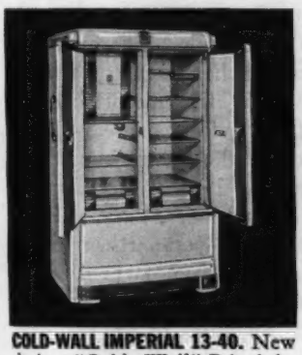
SUPER VALUE 6-40. Beautiful cabinet design. Chromium shelves. Quickube Trays. Cold Storage Tray. Big Super Freezer. Cold Control. Automatic Reset Defroster. 1-Piece Steel Cabinet. Dulux finish. Meter-Miser. Many more.

Super Value 6-40.
New Low Price Only **$127.50***



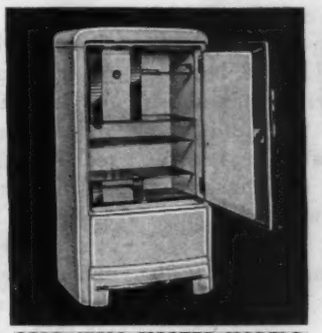
SUPER-VALUE 8-40. A big, spacious new model. Same features as Super-Value 6-40 model—Stainless Chromium shelves. Double-Easy Quickube Trays. 1-Piece Steel Cabinet. Dulux finish. Meter-Miser. And many more.

Super Value 8-40.
New Low Price Only **$166.75***



COLD-WALL IMPERIAL 13-40. New design. "Cold-Wall" Principle. Chromium shelves. Quickube Trays. Meat-Tender. Glass-Topped Hydrators. Adjustable Humidity Controls. Porcelain finish. Meter-Miser. Many more.

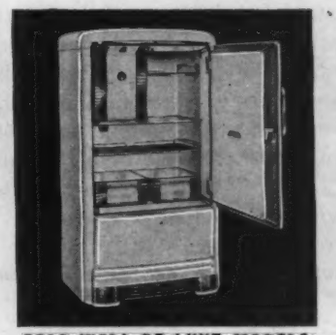
Cold-Wall Imperial 13-40.
New Low Price Only **$414.00***



COLD-WALL MASTER MODELS. New Beauty. Famous Cold-Wall Principle. Chromium shelves. Quickube Trays. Meat-Tender. Glass-Topped Hydrator. Adjustable Humidity Controls. Dulux finish. Meter-Miser. Many more.

Cold-Wall Master 5-40.
New Low Price Only **$167.00***

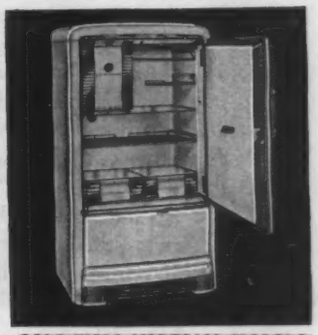
Cold-Wall Master 6-40.
New Low Price Only **$182.00***



COLD-WALL DE LUXE MODELS. New beauty. Famous Cold-Wall Principle. Chromium shelves. Quickube Trays. Meat-Tender. Glass-Topped Hydrators. Adjustable Humidity Controls. Dulux finish. Meter-Miser. Many more.

Cold-Wall De luxe 6-40
New Low Price Only **$212.00***

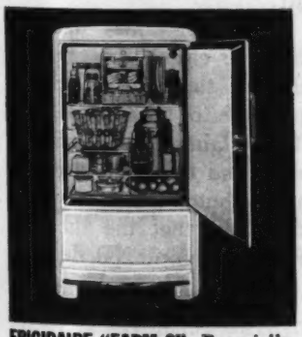
Cold-Wall De luxe 8-40.
New Low Price Only **$251.00***



COLD-WALL IMPERIAL MODELS. New beauty. Famous Cold-Wall Principle. Chromium shelves. Quickube Trays. Meat-Tender. Glass-Topped Hydrators. Adjustable Humidity Controls. Porcelain finish. Meter-Miser. Others.

Cold-Wall Imperial 6-40.
New Low Price Only **$236.50***

Cold-Wall Imperial 8-40.
New Low Price Only **$276.00***



FRIGIDAIRE "FARM 8". Especially designed for use in farm homes! Interior adjustable to any of 10 different arrangements for different foods and containers. Dozens of same advanced features as Frigidaire's other new models.

Frigidaire "Farm 8".
New Low Price Only **$171.75***

SELL ~~Buy~~ the Favorite SELL ~~Buy~~ Frigidaire

*** All prices quoted are Dayton delivered prices, and include installation, Federal Taxes and 5-year Protection Plan. Transportation, state and local taxes (if any), extra.**

LOAD BUILDING

Poultry-Wax Heater Improved

By C. W. WILDEBOUR
Agricultural Engineer,
Puget Sound Power & Light Company,
Puyallup, Wash.

An inexpensive device for heating wax used in plucking poultry by the wax method has been developed by the agricultural engineering department of Puget Sound Power & Light Company. One piece of equipment does the work which ordinarily requires two, and the new heater is believed to represent a lower first cost than either of the two units previously needed.

Plucking by the wax method consists of dipping killed, semi-scalded, partially ruffed birds into hot wax, then peeling off the wax when it has cooled. Heating is required, first, to maintain wax at the proper dipping temperature of 118 to 120 deg. F., and, second, to reclaim the wax that has been peeled from the birds. For efficient reclaiming 280 deg. F. is needed.

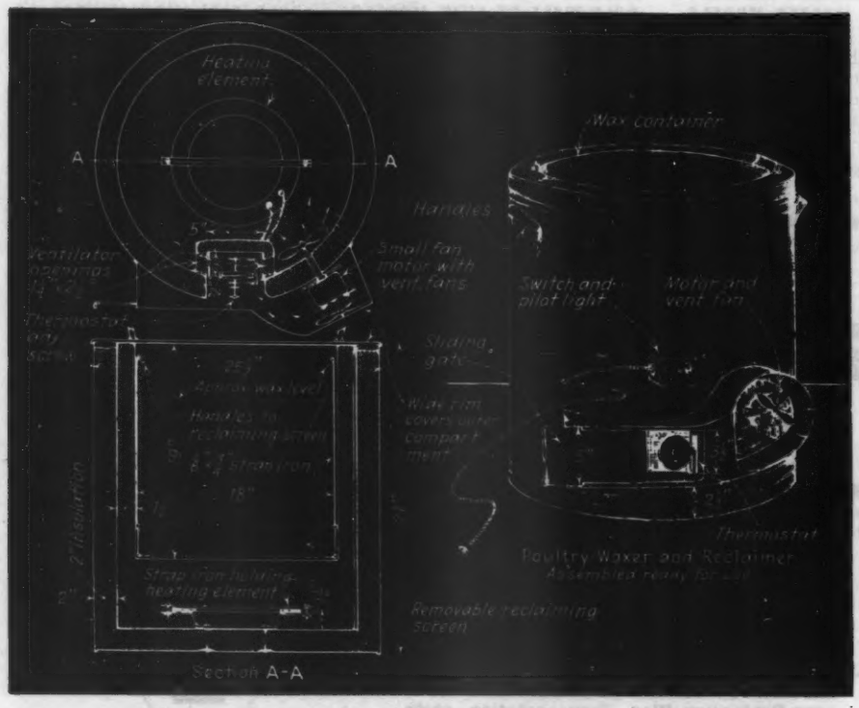
Low cost of the new equipment was made possible by two innovations: (1) Water jacketing was eliminated. It was this feature which prevented one piece of equipment from doing both jobs before, because the reclaiming temperature is above the boiling point of water. (2) A scheme of air circulation was introduced which permits maintenance of either temperature with one inexpensive thermostat.

The heater is composed of three telescoped, galvanized-iron cans. The inner can holds the wax; the next can provides an air space and also serves to hold insulation in place on its outside, and the third can performs the same function on its inside. A 1,000-watt heating element is located in the air space beneath the wax container.

For air circulation two 5½-in., four-bladed fans are driven in tandem by a small motor, situated as shown in the illustration. The inside fan circulates the heated air. The outside fan keeps the motor cool and, when the device is used for reclaiming, cools the thermostat.

The thermostat is an ordinary, wafer-disk brooder type. It is placed in a small insulated compartment—4x5 in. by 2 in. deep—which is situated in the air stream. There are three slide openings to the compartment. Two of the slides—constituting sides of the compartment—are situated between it and the air space around the wax container. The third slide permits opening the entire front of the compartment to the outside air.

With the two small slides open and the front slide closed the thermostat is adjusted to maintain the waxing temperature of 118 to 120 deg. Then, for reclaiming, the small slides are closed and the front slide is opened, and the outer fan so cools the thermostat disks that the thermostat will not open until 280 deg. is reached.



Section, plan, elevation of air-circulated unit for heating wax for poultry plucking

Use Aisle Fixture as Conveyor Light

Although they are more commonly used for lighting aisles, loading platform and similar long, narrow areas,

Filling Empty Sockets!

COME OUT FROM BEHIND THOSE LAMP BULBS, HONEY...
G-E MAZDA LAMPS
GENERAL ELECTRIC
THEY STAY BRIGHTER LONGER
... and tell me what's wrong with this reading lamp!
DISPLAY GIRL: I wouldn't do this for just anybody, but it gets tiresome being a mere display card. What is wrong with the lamp?
CUSTOMER: That's what I asked you. With the light it gives, I can hardly read the headlines in the paper!
HE: Hmmm. No wonder! A 40 watt bulb—when an I. E. S. lamp like this should have at least a 100! Shame on you!
HE: Aw, go on! Does it make that much difference what size bulb you use?
SHE: Does it! It can make all the difference between eyestrain and comfortable seeing. Why it's a wonder you haven't got nervous indigestion!
HE: I have!
SHE: And what's more, you weren't even using a G-E bulb. Don't you know that G-E MAZDA lamps stay brighter longer, and even the 100 watt size only costs 1¢?
HE: No! If that's the case, I'll take six — and to show my appreciation, how about a movie tonight?
G-E MAZDA LAMPS
Made to stay brighter longer
GENERAL ELECTRIC

THIS FULL PAGE G-E AD runs in the February 5th issue of LIFE. See how it sells the idea of the right bulb in the right place . . . and how it ties in with the display below!

THIS DISPLAY will appear in more than 25,000 store windows during the month of February. Displayed in almost every shopping district in the country, it will be a constant reminder to stock up on the 100 and 150 watt sizes of G-E MAZDA lamps.

THIS PERFECT "TIE-IN" is typical of the G-E advertising and dealer promotion that is helping to fill empty sockets and make customers more conscious than ever of the need for better light. A total of 625,000,000 G-E MAZDA lamp messages or an average of 26 messages per wired home will reach your residential lighting market this year. General Electric Company, Nela Park, Cleveland, Ohio.

G-E MAZDA LAMPS
GENERAL ELECTRIC
Made to stay brighter longer

Aisle lighting unit proves effective over conveyor

"Parabolite" fixtures have been used effectively in lighting the conveyor section where filled bottles are packed in cases at the new south side plant No. 2 of the Pepsi-Cola Bottling Company, Chicago, Ill.

The fixture, essentially an inverted trough-shaped reflector 21 in. long, is so designed that it projects a comparatively narrow stream of light downward and along the conveyor line. At the bottling works the eight units that are used provide 20 ft.-candles of light on the conveyor when used with a 100-watt lamp. They are mounted about 30 in. above the conveyor and are about 3 ft. apart on centers. Filled bottles pass along the conveyor at the rate of about 120 per minute.

•

Restore Revenue for $0.42 per $1 E.A.R.

By B. F. MULDOWN
District Sales Supervisor
Interstate Power Company, Albert Lea, Minn.

Faced with the problem of quickly regaining revenue lost through rate reductions, the Interstate Power Company has been successfully using several "customer survey crews" to build residential load with lighting through the house-to-house sale of low-cost, wall-type lighting units. Operating a crew of three men each in towns of under 1,000, the company found that crew members average 60 calls per week with an average of 1.03 lamps sold per customer interviewed. Total crew operating costs amount to 42 cents per dollar of E.A.R. and records of the activity show that after an entire town was covered the average bill increased an average of 20 cents per month. This, it is felt, was the result of the wall lamp activity.

In interviewing customers each crew member carried a box containing a wall lamp equipped with a 100-watt lamp, which was presented to the customer with the explanation that it was the company's desire to show each customer the value of diffused lighting by actually giving him an opportunity to use a modern wall lamp in his home. It was explained that the customer could try the lamp for 30 days and if during that period the lamp was not satisfactory it could be returned without obligation. However, at the end of 30 days if the lamp was not returned it was understood that the lamp was satisfactory and the amount would be billed.

Successful Load Builder

This load-building technique using the low-cost "pin-it-up" lamp included all classes of customers and proved most satisfactory in building load among customers who could not afford the purchase of more expensive electrical conveniences. This method proved so successful in building load at a reasonable cost, and at a satisfactory pace, that the company has recently added three more crews.

While the main function of the crews was to build load, they accomplished two other objectives, namely:

1. To explain to the individual customers how rate reductions, of which there were many throughout the territory, affected bills and how the saving could be used to operate additional electrical conveniences without additional cost.

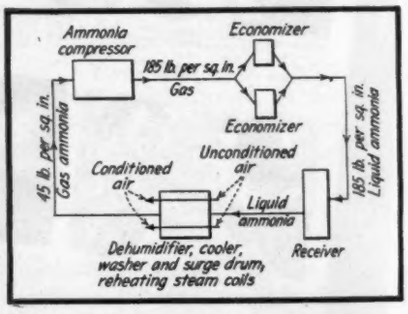
2. To obtain the customers' opinion of our service, picking up miscellaneous complaints, such as low voltage, radio interference, etc.

These objectives were aimed at renewing confidence in our customers' minds as to our desire to render better service. These objectives proved to be as important as the increase in revenue, as our customers were interested in the new rates and many of them realized for the first time just how low an electric rate they were paying. Reports of the various complaints also proved of great value to our operating department in determining the necessity of improving certain phases of service.

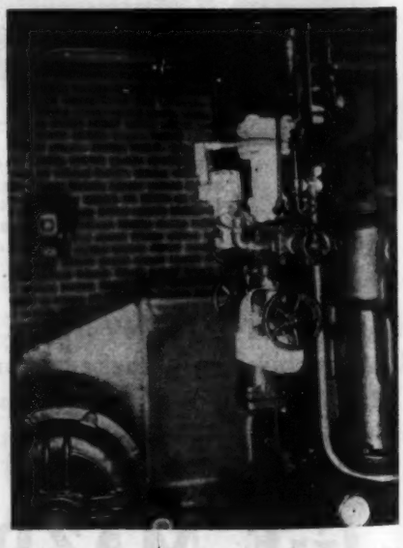
Air Conditioning for Chocolate Storage

To maintain the quality of product in storage under all weather conditions the celebrated chocolate manufacturing plant of Walter Baker & Company, Boston, installed a complete air-conditioning system in its two-story warehouse capable of holding the temperature at 65 deg. F. and the relative humidity between 50 and 54 per cent. The installation serves a building 180x52 ft., with a first floor 14 ft. and a second floor 24 ft. high, the structure being of brick with air spaces between walls. The equipment includes a 47.5-ton York ammonia compressor driven by a 50-hp. induction motor, two Sirocco fans capable of supplying 22,000 c.f.m. of cooled, washed and if necessary reheated air to the storage space, and economizer, receiver and dehumidifying apparatus of York manufacture, with extensive automatic control and piping facilities.

Hundreds of thousands of dollars



Schematic layout of air-conditioning system (not to scale)



47.5-ton ammonia compressor serves two factory stories as part of air-conditioning system protecting chocolate storage of Baker Chocolate Company

worth of chocolate are stored at times in the building, and maintenance of the necessary quality is a matter of very close temperature and humidity regulation, whatever the season of the year. The electrical equipment includes a 3½-hp. motor driving a fan of 6,000 c.f.m. capacity which supplies air to the second floor, and another of 5½-hp. rating driving a fan serving the first floor and having a capacity of 16,000 c.f.m. The compressor, a two-cylinder 7½x7½-in. machine, is driven by a V-belt at 325 r.p.m., the motor speed being 1,165 r.p.m. A centrifugal air washer pump is also provided, driven by a 7½-hp. motor.

•

Land Values Hold Key to Electrification

Any evaluation of the effectiveness of the rural electrification efforts of Wisconsin utilities, reported by B. E. Miller, Secretary of Wisconsin Power & Light Co., at Midwest Power Conference recently, shows clearly that economic status of different counties is a determining factor both in extension of rural lines and acceptance of service when it is made available.

Wisconsin utilities have made electric service available to 77,522 farms, or 41.6 per cent of farms in the state, and 31.8 per cent of all farms are using service. In the ten richest counties 81 per cent of farmers use service when it is available, but in the ten poorest counties only 70 per cent use service even when it is available.

Average land values appear to be a fair gage of the possibilities of rural (farm) electric activities. The accompanying table shows the results of sampling different areas of the state for per cent of farms electrified and average kilowatt-hours used by farmers and isolated business establishments. In each sample three contiguous government townships were included, or an area 18 miles long by 6 miles wide. In all cases local distribution centers, supplied by adequate transmission line facilities, are available for rural line extensions. It appears that the per cent of farms electrified in an area bears a close relation to the value of the land therein, the one exception being item four. Here, however, the higher percentage of farms electrified is offset by a lower use of kilowatt-hours. The same rules, regulations and rates apply to each of the above sample areas, and all such areas have received the same consideration in so far as promotional activities and applications for rural service are concerned.

When all counties in the state are grouped into five divisions to correspond to the five grades of "Economic Status" adopted by the state's Planning Board it appears that:

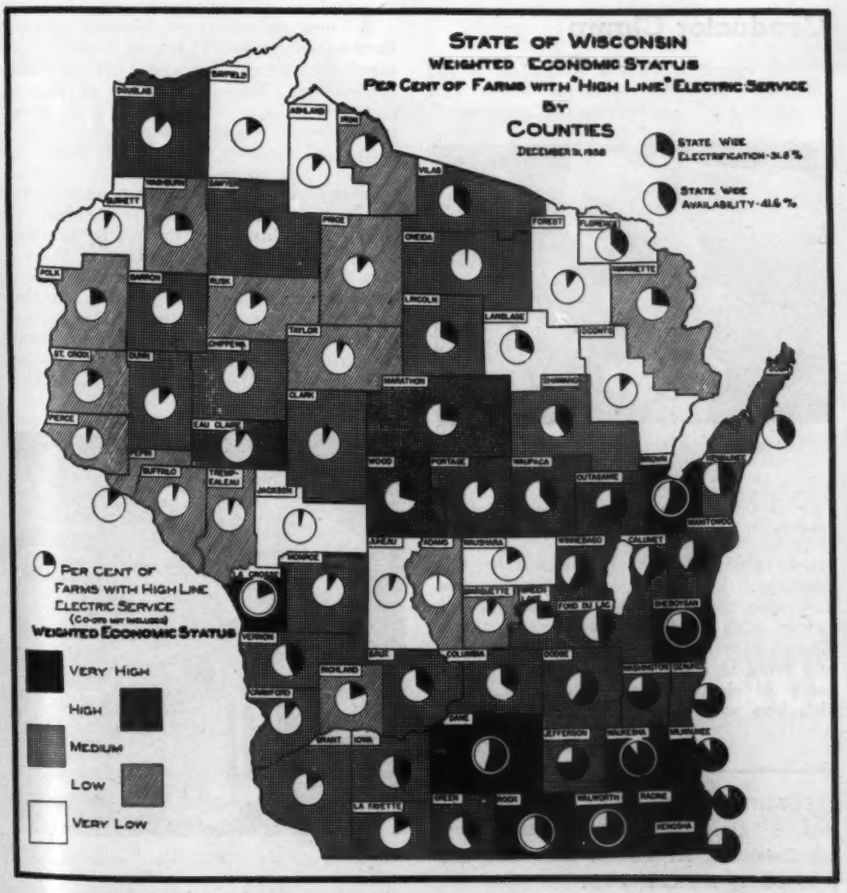
1. Where the "Economic Status" of the counties is "very high" high line service is available to 76.5 per cent of the farms and 62.4 per cent are connected.
2. Where the "Economic Status" of the counties is "high" high line service is available to 62.6 per cent of the farms and 42.4 per cent are connected.
3. Where the "Economic Status" of the counties is "medium" high line service is available to 20.2 per cent of the farms and 18.3 per cent are connected.
4. Where the "Economic Status" of the counties is "low" high line service is available to 18.3 per cent of the farms and 13.0 per cent are connected.
5. Where the "Economic Status" of the counties is "very low" high line service is available to 18.5 per cent of the farms and 13.0 per cent are connected.

These data pertain to high line service from utilities (private and municipal) only and do not include electric co-operatives as they do not operate in Wisconsin as utilities.

Sample Comparisons of Rural Electric Activities Versus Average Value of Farm Lands

Area	No. of Farms in Area	Average Value of Farm Land/Acre*	No. of Farms Connected†	% of Farms Connected	Average Kw.-Hr./ Farm per Year†
Walworth Co. 3 Towns	426	$73.00	386	90.7	1,631
Dane Co. 3 Towns	586	60.00	370	63.0	1,042
Columbia Co. 3 Towns	491	54.00	263	53.5	1,068
Waushara and Winnebago Counties. 3 Towns	415	43.00	235	56.6	874
Shawano Co. 3 Towns	436	33.00	206	47.0	880
Shawano Co. 3 Towns	419	29.00	65	15.5	813
Waushara Co. 3 Towns	354	23.00	16	4.5	1,470
Waushara Co. 3 Towns	391	17.00	11	2.8	1,185‡

* From data prepared by "Associated Consultants Inc."
† From records of Wisconsin Power & Light Company.
‡ Includes one large customer. State Experimental Station and Farm. Omit this tax-supported customer, the average use is 734 kw.-hr. per year.

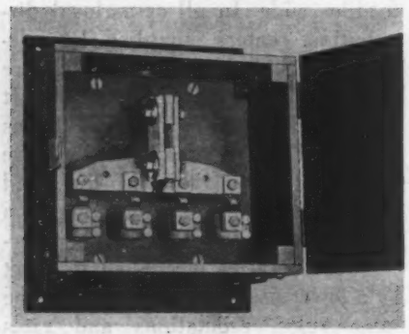


Rural electrification wins widest acceptance in counties of high economic status

NEW EQUIPMENT

Fuse Box

The box is fabricated of ebony asbestos material and is, therefore, only suitable for use in dry vaults. Each phase uses a separate box. Each box provides for fused



Fuse box designed for secondary network cables. **G & W Electric Specialty Co.**, Chicago, Ill.

connection of four 500,000-circ.mil maximum cables to a bus which is connected through the solid links and 1,000,000 or 1,500,000-circ.mil cable to the supply.

•

Welding Electrode

"Stainweld D," for arc welding stainless steel of the 25 per cent chromium, 20 per cent nickel type. **Lincoln Electric Co.**, Cleveland, Ohio.

"Stainweld D" may also be used for welding various stainless steels to mild steel and for welding of steels which are air hardened and cannot be heat treated after welding. Electrode size $\frac{5}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$ and $\frac{1}{4}$ in., length 11½ in.

•

Airdifiers

"Airdifiers," for removing moisture and oil from air and gas lines; complete in all sizes from ⅜ in. to 10 in. **Logan Engineering Co.**, 4912 Lawrence Ave., Chicago, Ill.

The dirt, scale, oil and moisture are removed by impinging on a multiplicity of propeller blades revolving in opposite directions and propelled by flow of air or gas. The arrested contamination and moisture are collected in the lower housing, from where they may be drawn off. Designed for application to the air lines of stationary and portable air compressors to protect drills, jackhammers and other air operated and actuated machines and equipment used in generating plants and line construction and maintenance, against sticking, damage and breakdown.

•

Belting Coating

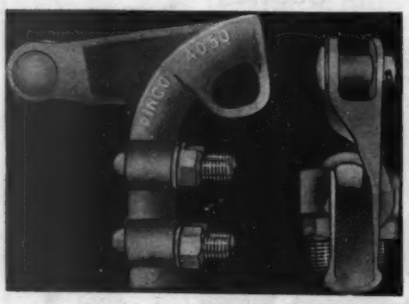
R-60-T protective coating for conveyor belting. **B. F. Goodrich Co.**, Akron, Ohio.

Because belting covers may suffer deterioration through the effects of sunlight and air during periods of idleness rather than when in use, this company has developed a synthetic coating which is claimed to reduce greatly the effects of aging.

•

Conductor Clamp

Side entrance with a weight of 3 lb., designed for low conductor stress and developing 97 per cent to 101 per cent of



Dead end clamp No. 4050 for all type conductors, especially ACSR No. 4 to 1/0 inclusive, as well as all copper or copperweld conductors ranging from 0.2 to 0.5 in. diameter inclusive. **Porcelain Insulator Corp.**, Lima, N. Y.

rated cable strength, is claimed by this company. Large conductor gripping area and compensated grip gives ample holding power with minimum conductor stress. Eye on nose of clamp to facilitate sagging and tying in conductor. Body and keeper made of electric furnace annealed malleable iron with steel U-bolts.

ELECTRICAL EQUIPMENT BUYERS look first in "Electrical World" *Electrical Buyers Reference* for names, addresses and products of manufacturers.

Pyranol Capacitor

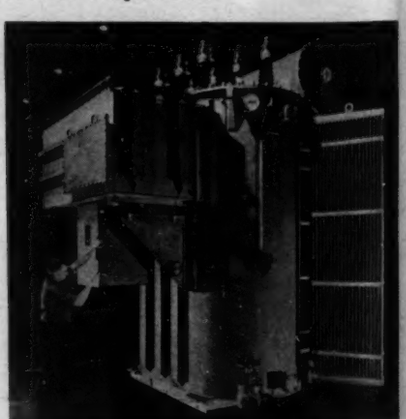
Pyranol-filled capacitors, "Class DTSR," for industrial use, to be mounted on a platform, on the floor or suspended from the ceiling. **General Electric Co.**, Schenectady, N. Y.

The bodies of the capacitor units are exposed to a stream of ventilating air, but the bushings, buses and fuses are inclosed in a dust-tight compartment. Conduit knockouts are provided on top and both sides for ease in making connections. There are no external discharge resistors as the resistors are built in. Fuse clips and fuse ferrules are silver-plated to eliminate oxidation.

•

Load Ratio Control

A new transformer load-ratio-control mechanism (type TLK) is available to supplement types TLF and TLB regulating mechanisms. Mechanism is for application on medium-large regulating and power transformers, single or three phase, automatic or manual control. It has dial switches and rotary breakers mounted on separate oil-filled compartments with mechanical interlocking so tap-changing circuits are closed and opened by breakers while changing taps. Rotary breaker opens and closes tap circuit through a quick-break spring drive similar to that used with type AFR step feeder voltage regulators. Driving motor and control apparatus are mounted in a weatherproof housing below the dial switch and rotary breaker compartments.



Type TLK load-ratio-control mechanism on three-phase regulating transformer for an 18,750 kva., 35-kv. circuit. **Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

-IN SPITE OF THE MAN WHO SAID-

"THERE'S NO SUCH ANIMAL."

BUT THERE STOOD THE GIRAFFE, AS PLAINLY VISIBLE AS HUBBARD FULL ROUND, TAPERED GUY PROTECTORS APPEAR TO PASSERS-BY. EVER PRESENT—EVER WATCHFUL—GUARDIANS OF THE HIGHWAYS AND BYWAYS.

HUBBARD AND COMPANY

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"HANG THE LOAD ON HUBBARD HARDWARE"

. . . LIKE SOLID METAL *mechanically, electrically . . because they're brazed with* Sil-Fos

Millions of electrical joints are made every year with the low temperature silver brazing alloy Sil-Fos.

This wide use, including most of the top-ranking organizations in the electrical industries, is convincing evidence that Sil-Fos does a reliable job and does it economically.

With copper, brass and bronze it makes joints that are just like solid metal—as strong mechanically and as efficient electrically—joints which have the ductility so necessary to withstand shock, vibration and temperature changes.

The low brazing temperature — 1300 Deg. F. — and the exceptional fluidity of Sil-Fos combine to give you sound joints with less labor and materials.

If the brazing of lugs, terminals, connectors, taps, wires, cables or bus bars is part of your production, it will pay you to *try* Sil-Fos. Write today for full details and Bulletin EW-52.

HANDY & HARMAN · 82 FULTON ST., NEW YORK

Agents in Principal Cities. In Canada: HANDY & HARMAN of Canada, Ltd., Toronto

Crane Light

This unit is made to withstand the severe service of under-crane mounting, states the company. It is installed under

"Cranelite," for illumination under cranes; perferably to be placed on 20-ft. centers. **Holophane Co., Inc.**, New York, N. Y.

the catwalk and is relamped by raising up a section of the catwalk floor or it is mounted on the edge of the catwalk and swung up for relamping by using an angle section for attachment to the catwalk. It is fastened to the crane by a 10-inch diameter, ½-in. thick steel plate. The weight of the unit is suspended from this plate by three compound double-acting steel springs.

•

Unit Heater

To the standard unit heater has been added a new built-in control to provide day and night settings of temperature. **Carrier Corp.**, Syracuse, N. Y.

Automatic heat control is afforded by a hydraulic-action bulb type thermostat which has a 60 deg. adjustable range. A special setting for fan operation during the summer insures a positive air circulation. This heater finds uses in factories, stores, etc.

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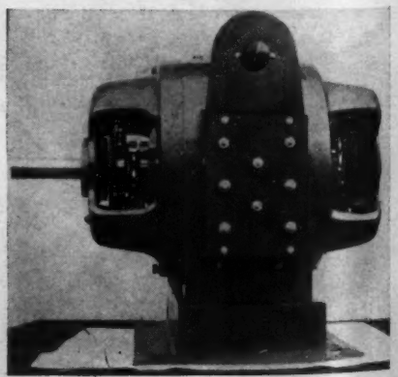
D.C. Motor

Because it furnishes the 60-cycle a.c. current, this motor should be helpful to those manufacturers located in d.c. pow-



Katolight d.c. motor, which furnishes 60 cycles a.c. current for the operation of an auxiliary function. **Kato Engineering Co.**, 530 North Front St., Mankato, Minn.

TEN REASONS WHY
you should use the original
ROCKBESTOS A.V.C. WIRE AND CABLE

1 HEATPROOF
Because Rockbestos insulation won't dry out, become brittle, flake or crack to open paths for current leakage and moisture.

2 FIREPROOF
Because Rockbestos A.V.C. Wire has laminated insulation of felted asbestos, varnished cambric and asbestos braid that won't burn or support flame even under an arc.

3 PERMANENT
Because the asbestos in Rockbestos insulation won't deteriorate under heat or with age and is always "as good as new."

4 REDUCES MAINTENANCE EXPENSE
Because Rockbestos heatproof and fireproof qualities give you long-term service and make periodic replacement unnecessary.

5 RESISTS HEAT AND VIBRATION
Because heat can't dry out or crack the Rockbestos insulation, vibration doesn't get a chance to open it up and shake it loose.

6 SAVES WORK
Because Rockbestos stops the merry-go-round of failures and replacements in hot-spots where ordinary wire has a short life.

7 OIL, GREASE AND MOISTURE RESISTANT
Because Rockbestos A.V.C. won't rot or swell due to oil, grease or corrosive fumes and has ample moisture resistance.

8 HIGH OVERLOAD CAPACITY
Because copper heating won't break down or deteriorate the insulation, Rockbestos gives you greater carrying capacity.

9 PERMANENTLY FLEXIBLE
Because asbestos never loses its original characteristics, Rockbestos A.V.C. Wire and Cable doesn't get hard, stiff or crystallize.

10 LONG SERVICE
Because country-wide users testify that Rockbestos Wires and Cables have been giving failure-free service ever since we designed them twelve years ago. Names in your locality furnished on request.

For your requirements the Rockbestos line contains the most complete assortment of heat resisting wires, cables and cords available, in either of the widely used Rockbestos A.V.C. or All-Asbestos constructions. More than fifty standard wires to draw upon, and a research department which is always ready to design a "special" if you need one. For our No. 10-E Catalog write to Rockbestos Products Corporation, 949 Nicoll St., New Haven, Conn., "Headquarters for Heat-Resisting Wires," or get in touch with our nearest branch office.

Also refer to Electrical Contracting and Electrical World Buyer's Reference Editions.

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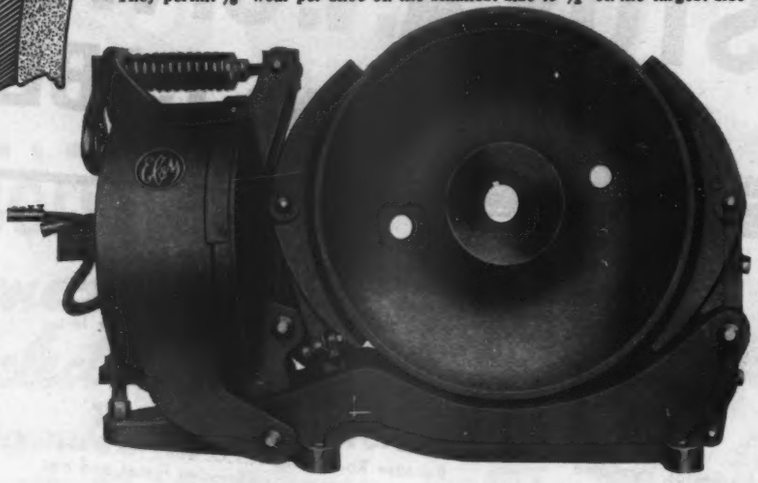
Better Brakes, too for INDUSTRY

EC&M TYPE WB BRAKES

These Brakes are designed for Long Life

They permit 1/8" wear per shoe on the smallest size to 1/2" on the largest size



No other Brake permits such long wear as the Type WB

LIKE the automotive field, industrial traffic is also quicker. Faster operating speeds and a greater use of anti-friction bearings necessitate better brakes for overhead cranes and other industrial motor-driven machines.

In EC&M Type WB Brakes, a molded brake-blok type of lining is used. It has excellent wear-resisting qualities, is extra thick and wears down slowly and uniformly.

Other exclusive features of this direct current operated brake are:

Manual Release for Emergency Operation—a standard feature on all EC&M Type WB Brakes. It is an advantage of outstanding merit when changing brake-shoes, checking the clearance between shoes and the brake-wheel, setting up machinery, removing motor armatures or for lowering a load under manual control in emergencies.

No Rods of Levers over Top of Brake Wheel—this radically different feature permits motor-armature-replacement without dismantling the brake or disturbing any adjustments.

Study the design of this brake to learn why *"The Trend is toward EC&M Type WB Brakes"*. Bulletin 1004-B gives the complete facts. Write for your copy to-day.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

ered areas when machine shop equipment is required that demands alternating current. May be used to furnish low-voltage current for the operation of relays and controls, on machine tools and processing machinery; synchronous motors as used on time cycle equipment and operation of fluorescent type lamps.

•

Speed Indicator

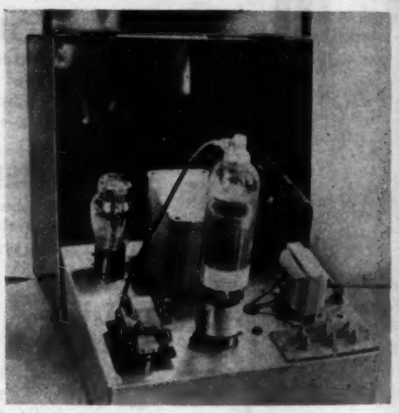
Speed indicator for measurements on high-speed grinding spindles, motors, steam turbines, etc. **Herman H. Sticht & Co.**, 27 Park Place, New York, N. Y.

This indicator is the latest addition to the group of chronometric type speed-measuring devices made by this company. A high-speed hand tachometer, it is so designed that one revolution of the large sweep hand is equal to 10,000 r.p.m., or 100 r.p.m. per division. One revolution of the small hand is equal to 100,000 r.p.m. The instrument weighs approximately 15 ounces.

•

Automatic Timer

This timer functions by allowing current to flow for each weld only for the full duration of a single half-cycle of the 60-cycle supply and by blocking further current flow until the manually operated switch at the welder is again tripped for the next weld. A grid-controlled rectifier (type C6J) capable of handling welding currents up to 77 amp. is utilized in the circuit.



Automatic timer for welding small parts or thin materials; control action entirely electronic. **Callite Products Co.**, Division Eisler Electric Corp., Union City, N. J.

•

Electric Shear

"Thor Nibbler," a small, portable electric nibbler for cutting all kinds of sheet metal; will cut up to No. 18 gauge (0.049 in.) in steel and up to No. 15 gauge (0.072 in.) in aluminum. **Independent Pneumatic Tool Co.**, 60 W. Jackson Blvd., Chicago, Ill.

Only 9 in. long and weighing 3¾ lb., this device is a compact tool with a yoke type front head incorporating a punch and die that cuts out a rectangular shaving of metal at each upward stroke of the punch. Internal cuts of any shape may be made by drilling or punching a hole 1 in. in diameter and inserting the head of the tool in this hole. The front head can be loosened and turned to either right

New DIESEL TRACTRACTORS by INTERNATIONAL HARVESTER

A YEAR AGO we announced the big, powerful TD-18 TracTracTor, a new top for Diesel crawlers. Today International Harvester presents a rugged quartet of streamlined crawlers —TD-18, TD-14, TD-9 and TD-6. FOUR *Diesel TracTracTors for 1940*—big news from the world's leading tractor builder to *all* operators of crawler tractors!

Here's the complete line-up for you to look over—the big fellow at the right, already a popular favorite in the heavy-crawler field; his little brother at the far left; and the step-ups in between. There's not an ounce of lazy horsepower in any of them! They're ready to tackle their weight in wildcats—each one is ready to lick the crawler-power problems in his range!

In this complete series of TracTracTors, INTERNATIONAL offers you a new standard of Diesel performance and economy—perfectly designed balanced power in capacities to meet every demand of crawler-tractor users. Standardize on International and enjoy all the advantages only Harvester can provide. Get the full story from any International industrial power dealer or Company branch, or write us.

A great variety of specially designed allied equipment available for all TracTracTor sizes.

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Now 4 Sizes

RUBBERCOVERED POWER CABLES • BUILDING WIRE

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Insulated WIRE and CABLE

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

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Afloat as well as ashore you'll find CRESCENT Insulated Wire and Cable giving maximum performance under the most severe conditions of service—excessive heat, aging and moisture; all-weather exposure; corrosive action of acids and alkalis; vibration and abrasion. One foot or a million, one type or a dozen, there's only one quality in the entire CRESCENT line.

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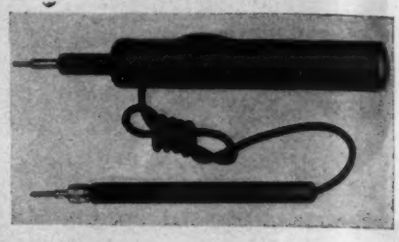
CRESCENT ENDURITE SUPER-AGING INSULATION

or left and set at an angle of 30 or 90 deg. Suitable for both shop production and on-the-job installation work.

•

Safety Test Lamp

A large test prod holder contains a 5,000-ohm, 20-watt capacity resistor, a lamp socket, long-life filament Mazda lamp and magnifying bulls-eye. Lamp socket is wired above resistor, with the single test lead wired to side of lamp socket. The 5,000-ohm resistor and lamp filament are wired in series between test prods. It is



"SG-100" test lamp and voltage indicator, distributed for a.c. or d.c. circuits from 110 to 600 volts. Sittler Co., 1133 West Van Buren St., Chicago, Ill.

stated that this construction eliminates accidental shorting-out of resistor. While resistor winding could open, its single layer eliminates shorting or "splash," according to the makers. Current values are in milliamperes; a 110-volt circuit indicates about 20 milliamperes light value through the tester; 220 volts, about 40; 440 volts, about 80; and 600 volts, about 110 milliamperes.

•

TECHNICAL LITERATURE

MAZDA LAMPS—The characteristics and applications of three types of lamps—incandescent, gaseous discharge and fluorescent light sources—are described together with a pictorial summary of the production of light in a new bulletin (LD-1) published by the Nela Park Engineering Department of the General Electric Company, Cleveland, Ohio, at 30 cents each.

INDUSTRIAL CAPACITORS—Gives a general description of electrolytic motor starting capacitors, power-factor control and a capacity-current power-factor chart. Copies are available from Aerovox Corp., New Bedford, Mass.

MOLDED CERAMIC PRODUCTS—A brief survey of technical characteristics of molded ceramic products, showing what they are, industrial uses and applications, kinds of ceramics for special usages and the different types of molding. Applications are for electrical wiring, electrical heating and special applications. Published by the Star Porcelain Co., Trenton, N. J.

POWER FACTOR AND ITS IMPROVEMENT—Discusses power factor and how it can be corrected through the use of capacitors. Gives tables, examples and charts for the calculation of capacitor sizes. Specified as Bulletin No. GEA-3225, it can be obtained from the General Electric Co., Schenectady, N. Y.

NEWS ABOUT PEOPLE

Cheney & Foster Admits A. E. Ward as Partner

Artemas E. Ward, for many years with W. S. Barstow & Co. and the Utility Management Corp., has been

Blank & Stoller

admitted to partnership in Cheney & Foster, engineers and consultants, New York. Mr. Ward has been active in public utilities for more than 30 years, his experience embracing financial, accounting, management and sales promotion work. He is a former vice-president and director of the New Jersey Power & Light Co., and is a member of the plan committee of the Modern Kitchen Bureau.

In his new capacity Mr. Ward will assist in expanding the business of Cheney & Foster in the utility field and among industrials.

•

▶ L. P. GOETZ has been appointed valuation engineer for the Utah Power & Light Co., Salt Lake City.

▶ DR. FRANK CONRAD, assistant chief engineer of the Westinghouse Electric & Manufacturing Co., was made the recipient of the 1940 gold medal of the American Institute of the City of New York "for his pioneering work in short-wave radio and frequency modulation and for his guiding genius in developing the world's first radio broadcasting system." Presentation was made last week at a dinner in the Hotel Pierre.

•

Wilson Named President of Quebec Power Company

James Wilson, president of the Shawinigan Water & Power Co., was elected president of Quebec Power Co., to succeed the late Julian C. Smith. W. S. HART, vice-president of the Shawinigan Water & Power Co., has been elected a vice-president of Quebec Power Co. and will continue to act as treasurer. H. G. BUDDEN was named secretary of the company, filling the position formerly held by Mr. Wilson. R. J. BEAUMONT, an assistant general manager of Shawinigan, has been elected a director of Quebec Power Co., filling the vacancy caused by the death of Mr. Smith.

•

▶ ALLAN BROOKS has been appointed secretary of the Massachusetts Department of Public Utilities, following about 20 years of service with the board and a recent period as administrative secretary. LEONARD C. HARDY, former member of the commission, has been appointed administrative secretary.

▶ ELMER C. DVORAK has been appointed sales manager of General Electric ranges and RAY RICH as sales manager of G. E. water heaters. A native of Cleveland, Mr. Dvorak has been district representative for G. E. ranges and water heaters for Ohio, Michigan, Kentucky and Indiana since 1937. Mr. Rich has been charged with the responsibility of promoting water heater sales since 1938, when he was recalled to headquarters from the Pacific Coast, where he had been district range-water heater specialist.

Thomas W. Rolph Honored as a "Modern Pioneer"

On the occasion of the 150th anniversary of the founding of the American patent system, the Committee on Modern pioneer Awards, headed by Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, will honor Thomas W. Rolph, chief engineer of the Holophane Co. by presenting him with an award as a "Modern Pioneer." The formal award is to be made on February 21.

This distinction comes to Mr. Rolph for his pre-eminent contributions as an inventor in the field of illuminating engineering during the past 25 years. His inventions have been on traffic control lenses for clearer indications to motorists and pedestrians to promote

safety; on airport boundary globes; on refractors for effective street lighting; on the design of desk and table lamps; of a structural glass brick unique in its prismatic construction, and numerous inventions on other lighting equipment.

•

▶ JAMES A. ECCLES of Montreal has been elected a director of the Shawinigan Water & Power Co. to fill the vacancy caused by the death of Julian

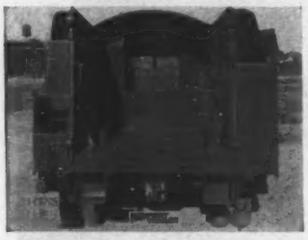
HIGHWAY TRAILERS

FOR LONG, TROUBLE-FREE SERVICE

BUILT TO BEST MEET THE NEED . . .

EARTH BORING MACHINES: for truck or tractor mounting.

WINCHES: several types and sizes



BODIES: for construction—maintenance—installation—service

POLE DERRICKS: several available sizes

★ **POLE TRAILERS**

Several types ranging in capacity from 1500 to 10,000 lbs. Designed to carry full load on trailer permitting use with any type of utility truck. Used for many other purposes when not hauling poles.

★ **COMBINATION POLE AND CABLE REEL TRAILERS**

Developed especially for companies having a limited need for a standard cable reel trailer—affords as effective a means of loading and transporting cable as the standard cable reel trailer.

★ **"CABLE SPLICERS" TRAILERS**

A splicer's workshop on wheels—weatherproof—thiefproof—fireproof. Ample space for tools and materials usually required by the splicer.

★ **PUMP TRAILERS**

Especially designed for the permanent installation of small but powerful pumps. Quickly attached to truck can travel at fastest speeds.

★ **TRANSFORMER AND MACHINERY TRAILERS**

Designed to facilitate loading and transporting transformers, machinery, reels of cable, and other equipment of a heavy and bulky nature. Types for every need.

★ **CABLE REEL TRAILERS**

Provide a quick and effective means of loading and transporting heavy and unwidely reels of cable. Low center of gravity of load insures safe transportation at high truck speeds.

WRITE FOR INFORMATION

HIGHWAY TRAILER CO.
EDGERTON WISCONSIN

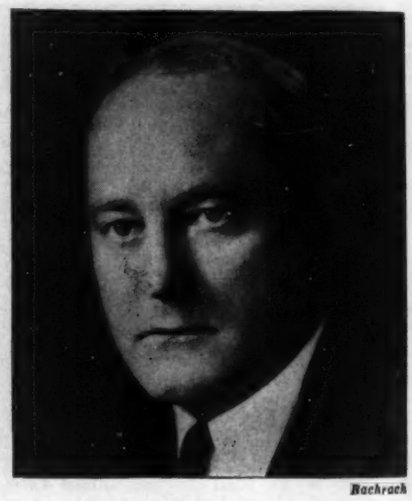
C. Smith. Mr. Eccles is engaged in the management of investment funds of various estates and of such institutions as McGill University and Royal Victoria College.

▶ ALBERT R. LEIGHTON, chief special agent of the Commonwealth Edison Co., retired from active service on January 1, after having been with the Edison company for 40 years. Mr. Leighton entered the company's employ in 1899 as an inspector in the inspection department and became a special agent in 1913. He was named assistant chief special agent in 1927 and chief special agent in 1938.

•

Roebling Makes Emerson General Sales Manager

Edward D. Emerson, since 1937 district sales manager with Babcock & Wilcox Tube Co., New York, has been appointed general manager of sales for



Bachrach

John A. Roebling's Sons Company, Trenton, N. J.

Mr. Emerson is a graduate in mechanical engineering, Harvard University, class of 1923. Previous to his connection with Babcock & Wilcox he was for several years sales engineer with the Jones & Laughlin Steel Corp. He will assume his new duties on March 1.

•

▶ FRANK P. HYER, assistant chief of the rates and research division of the Wisconsin Public Service Commission, has joined the staff of the Bonneville Dam project with headquarters in Portland, Ore.

▶ SIR HARRY BROWN has been appointed chairman and managing director of the British General Electric Co. Proprietary, the Australian subsidiary of the British General Electric Co. Edward Hirst will be associated with him as joint managing director and vice-chair-

man. Sir Harry Brown went to Australia in 1923 as technical adviser in connection with Post Office matters and was afterward appointed director-general of posts and telegraphs for the Commonwealth.

▶ O. D. VAN DYKE, superintendent at Imperial, Calif., for the Nevada-California Electric Corp., has retired after thirteen years of service. More than 150 persons, citizens and employees of the utility, attended a meeting to pay tribute to Mr. Van Dyke.

▶ GERALD HULETT has been elected vice-president in charge of sales of the Electromaster, Inc., Detroit. Mr. Hulett previously had occupied the position of general sales manager in charge of the marketing of the company's line of electric ranges, electric water heaters, electric teakettles and "Electro-Pails."

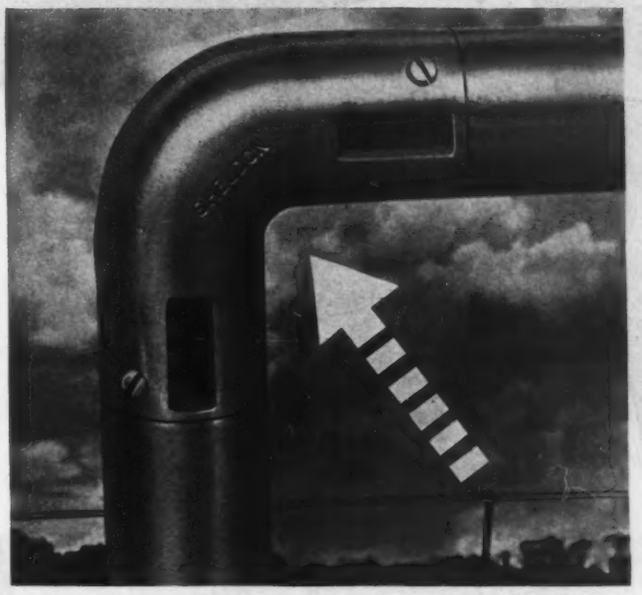
▶ STEWART E. LAUER has been elected president of the York Ice Machinery Corp., York, Pa. WILLIAM S. SHIPLEY, president of the corporation for the past ten years, was elected chairman of the board of directors. Mr. Shipley will remain in active service. Mr. Lauer has been associated with the York Ice Machinery Corp. and its predecessor, the York Manufacturing Co., for nearly 30 years. He became general sales manager in 1931 and was vice-president in charge of sales before his election to the presidency.

▶ WILLIAM L. BATT, president of SKF Industries, Inc., has been elected chairman of the board of directors of the American Management Association. Recognized as a leader of the international management movement, Mr. Batt is also president of the International Committee of Scientific Management, the organization which sponsored the Seventh International Management Congress held in Washington in 1938. He has long been active in management and engineering circles in the United States. A former president of the American Society of Mechanical Engineers, Mr. Batt is now Chairman of the Business Advisory Council for the Department of Commerce, a director of the National Association of Manufacturers and chairman, division of engineering and industrial research, National Research Council.

▶ FRANK T. KALAS, general sales manager of the Electric Storage Battery Co., Philadelphia, was elected third vice-president at a recent meeting of the board of directors. In the course of his connection with the Electric Storage Battery Co. Mr. Kalas has served as salesman, Washington branch manager, district manager, assistant general sales manager and general sales manager. He has had long and varied

SHELDON NOBOLT

HIGH PRESSURE INTERNAL EXPANSION ELECTRICAL Connectors



MAKES TUBING, BENDS, TAPS, ETC. LOOKS LIKE ONE CONTINUOUS PIECE

Easy to install
Cannot vibrate loose
Easy to insulate
Reduces corona losses

write for circular

SHELDON SERVICE CORPORATION

LONG ISLAND CITY, N. Y.

Let this Trico Combination SAVE YOU MONEY!

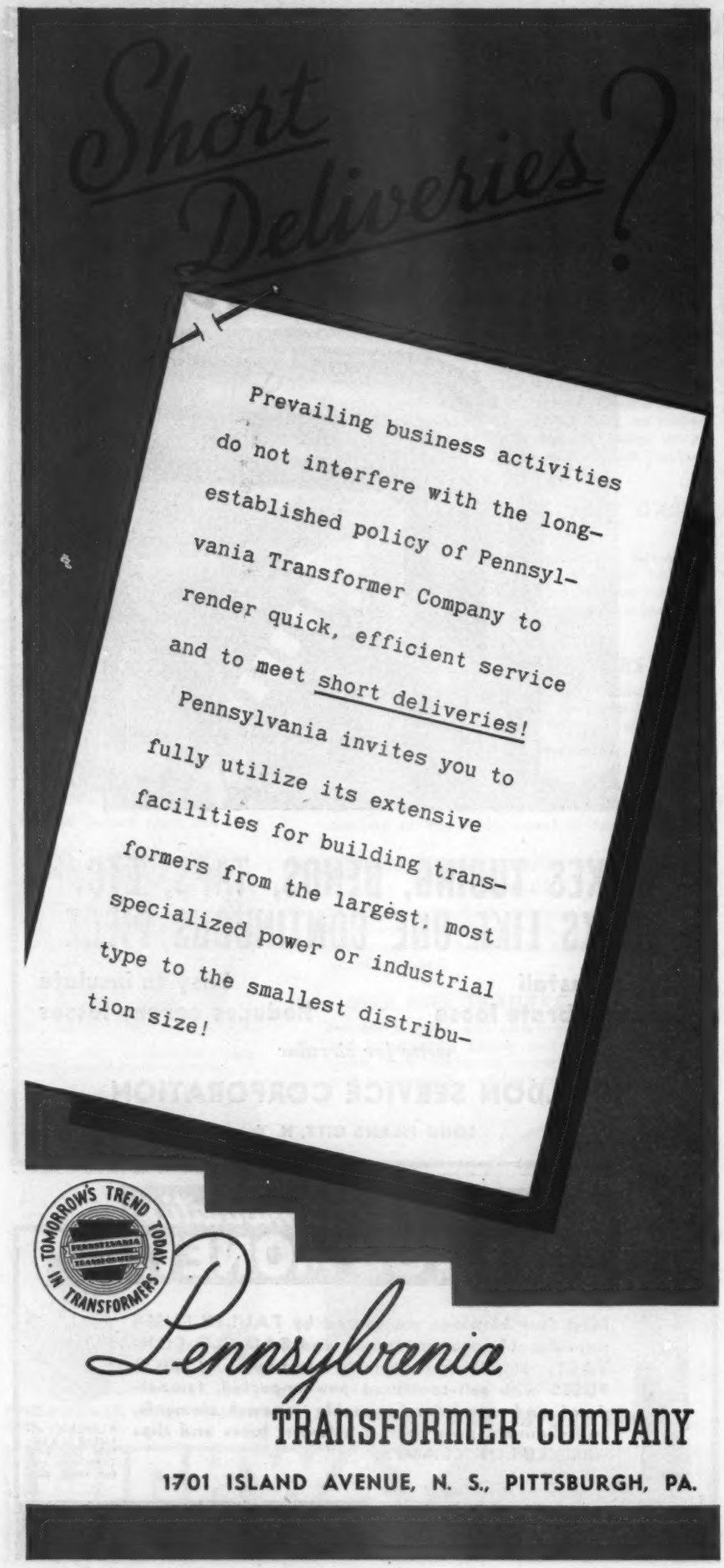
Most fuse blowings are caused by FAULTY FUSES unmistakably poor in design, and BAD CLIP CONTACT. Stop this unjustifiable waste by using TRICO FUSES with self-contained powder-packed, tamper-proof and non-interchangeable renewal elements, and eliminate poor contact between fuses and clips with KLIPLOK CLAMPS.

KLIPLOK attached to a ferrule type clip. There's a size for every clip.

That powder-packed element means better fuse service.

Write for Folder 206-Y "The inside story of TRICO FUSES", and Folder 257 on KLIPLOK CLAMPS

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal


Short Deliveries?
Prevailing business activities do not interfere with the long-established policy of Pennsylvania Transformer Company to render quick, efficient service and to meet short deliveries!
Pennsylvania invites you to fully utilize its extensive facilities for building transformers from the largest, most specialized power or industrial type to the smallest distribution size!
TOMORROW'S TREND TODAY IN TRANSFORMERS
Pennsylvania
TRANSFORMER COMPANY
1701 ISLAND AVENUE, N. S., PITTSBURGH, PA.

experience in all fields of storage battery application and will direct the sales activities of the company as vice-president and general sales manager.

OBITUARY

▶ JOSEPH C. COLLINS, retired treasurer and secretary of the Rochester Gas & Electric Corp., Rochester, N. Y., died January 31 at Miami, Fla., at the age of 76. He retired last August after being with the company since 1907.

▶ CARL W. WIGGINS, 68, who rose from a laborer to chief engineer of San Diego Consolidated Gas & Electric Co., died suddenly, following a heart attack, January 17. His service of 46 years with the company was the longest of any employee. Born in Kansas, he went to San Diego 50 years ago. He was affiliated with the National Association of Power Engineers and the Pacific Coast Electrical Association.

▶ WILLIAM S. DAVIS, vice-president and former sales manager of the Simplex Wire & Cable Co., Boston, died at his home in Melrose, Mass., January 27. He was born in Chelsea, Mass., in 1874 and had been in the company's employ for more than 43 years. He was a co-developer of "Fibrex" tree wire and was sales manager from 1919 to the spring of 1938.

▶ CORNELIUS M. CARBONELL, retired assistant secretary of the Consolidated Edison Co. of New York, died January 28 in Miami, Fla. He was 72 years old. Born in Havana, Cuba, Mr. Carbonell joined the old Consolidated Gas Co. in New York in 1888. In 1902 he was appointed assistant secretary of the Astoria Light, Heat & Power Co., a subsidiary. In 1919, while retaining his Astoria position, he was appointed assistant secretary of the Consolidated Gas Co., a position he retained after the company became the Consolidated Edison Co. He retired in 1937 after 50 years of service.

▶ GUSTAV A. KOSCHIN, founder and president of the Koschin Co., Milwaukee, Wis., which designs and builds special electrical machinery, died December 15, of a heart attack, at his home in that city. Born in Cologne, Germany, Mr. Koschin came to this country in 1892. For seventeen years he was employed by the Pawling-Harnischfeger Co., now the Harnischfeger Corp., as a machinist and later as a foreman in the electrical department. He was an electrical engineer and later became an electrical contractor, then head of the electrical department of the Horlick Malted Milk Co. at Racine. When he returned to Milwaukee in 1923 he founded the Koschin Co.

MEN LIKE THESE CAN BUILD BUSINESS FOR YOUR ELECTRICAL PRODUCTS

ELECTRICAL CONTRACTOR

Whitworth Ferguson, of the Ferguson Electric Construction Co., Buffalo, N.Y.

"I received 50 returns from my ad the first week the magazine was out," a manufacturer of electrical fittings told us recently . . . a typical example of the *pulling power* of Electrical Contracting.

. . . CHIEF ELECTRICIAN

John Peters, Chief Electrician of the Daily News, New York City.

Thousands of electrical contractors and plant electrical men can, *and will,* build business for you IF—

—you talk to them in their own language, in terms of *their own interests.*

—you tell your story regularly in the place where these men look for information about their business — ELECTRICAL CONTRACTING.

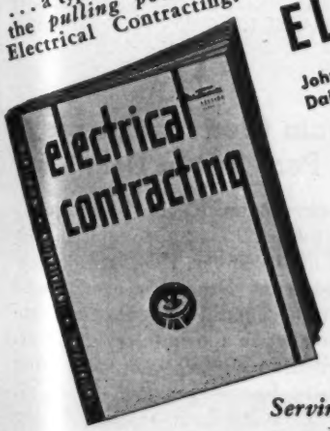
—you include all the buyer needs to know about your products to *take action.*

Do this consistently, and just as sure as night follows day, *you'll get more business.* A leading manufacturer of wire for example, followed this formula, and in two short years went from seventh to second place, in the favor of electrical buyers.

We've a data book that gives valuable market facts, and a quick picture of ELECTRICAL CONTRACTING magazine—in a helpful way, without ballyhoo. We'll send it along at the drop of a postcard, and will be glad to supplement it with further information drawn from 39 years of intimate contact with the field of electrical construction.

TESTED READERSHIP — A McGRAW-HILL PUBLICATION

330 WEST 42nd ST., N. Y.



electrical contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION AND MAINTENANCE

Serving Electrical Contractors, Electrical Men in Large Plants, and Other Electrical Buyers

MANUFACTURING - MARKETS

Cutler-Hammer Earns $1.23 a Share in '39

Preliminary report of Cutler-Hammer, Inc., for the year ended December 31, subject to audit, shows net income of $814,700 after depreciation, interest, federal and state income taxes, etc., equal to $1.23 a share on 659,998 shares of capital stock outstanding. This compares with net loss of $307,438 in 1938. Current assets as of December 31, last, amounted to $4,779,098 and current liabilities were $959,125, comparing with $3,668,320 and $346,188, respectively, at the close of 1938.

BLAW-KNOX—Including subsidiaries, ten months to October 31, net income, $486,870, equal to 36 cents each on 1,334,458 capital shares, according to figures filed with the Securities and Echange Commission.

CORNELL-DUBILIER ELECTRIC—For the year ended September 30, net profit, after federal tax deductions, $183,722. This is equivalent to 69.3 cents per share on outstanding common stock of 264,640 shares.

•

New $60,000 Factory

Westinghouse Electric & Manufacturing Co. has awarded contracts for construction of a new factory unit at its East Pittsburgh works, to cost $60,000. Construction is under way on a $50,000 addition to its Sharon, Pa., plant.

•

G.E. Television

Network television was demonstarted successfully to Federal Communications Commission members in Schenectady last week by General Electric engineers. The first demonstration of its kind in history, in which a program transmitted from New York was clearly received in Schenectady homes, 142 air-line miles away, was made possible by use of General Electric's new relay station working in conjunction with its main transmitter atop the Helderberg Mountains.

•

Supply Contracts Awarded by Government Agencies

Among the supply contracts awarded recently by Federal agencies were the following for electrical and allied equipment:

Electric Storage Battery Co., War, battery, $11,368.

Worthington Pump & Machinery Corp., TVA, air compressors, $33,990.

Circle Wire & Cable Corp., Maspeth, Long Island, Panama Canal, copper cord, $16,086.

Acorn Insulated Wire Co., Panama Canal, copper wire, $14,158.

Habirshaw Cable and Wire Division, Phelps Dodge Copper Products Corp., Panama Canal, copper cable, $15,289.

Thomas A. Edison, Inc., Navy, unit gauge indicators, $38,241.

•

Navy Contracts Go to G.E.

The Navy has awarded to the General Electric Co. a $243,569 contract for control and switchgear. The company also received contracts amounting to $83,215 for gauges.

•

Employees Given $63,899 For New Ideas in 1939

Employees of the General Electric Co. in 1939 received $63,899 for new ideas adopted under the company suggestion system. This was $12,497 more than they received in 1938. Cash awards ranged all the way from $2 to a top of $525. During the year 26,901 suggestions were made by employees, which was 6,702 more than in 1938. Of this total, 10,121 were adopted.

In the past 20 years more than $1,000,000 has been paid to employees for new ideas and better ways to do the job.

Manufacturers Make Sales Assignments

Railway and Industrial Engineering Co. has announced that it has enlarged its Pacific Coast territory covered by Charles Croft, a direct representative, with offices in Los Angeles. In addition to the territory now covered he will take over northern California and the southern part of Oregon. The northern part of Oregon and the state of Washington will be handled by E. A. Olsen with offices in Seattle. Mr. Olsen is a manufacturer's agent. John W. Clarke Co., Chicago, which represents the company in Minnesota and North and South Dakota, has opened an office in Minneapolis better to serve this area. The Minneapolis manager is Robert E. Burlingame.

The Maytag Co., Newton, Iowa, has appointed R. W. Weed manager of the Minneapolis branch. Mr. Weed was formerly assistant branch manager of the Indianapolis office.

Graybar Electric Co. has appointed Charles S. Powell, recently telephone sales manager in New York City, New England district manager with headquarters at 286 Columbus Av., Boston. He will direct operations at that location for the Providence, Worcester and Springfield branches in addition to the Boston area. Mr. Powell has been connected with Graybar for the past 25 years.

McGill Manufacturing Co., Valparaiso, Ind., has named Lee Raley of Dallas, Tex., representative in the states of Colorado, Utah, New Mexico and Wyoming effective April 1.

•

Vacuum Cleaner Sales Up 23 Per Cent in December

Electric vacuum cleaner sales in December totaled 155,201, compared with 126,153 in December, 1938, an increase of 23 per cent. December also topped the previous month, 141,066, the highest November in the industry's history, by more than 10 per cent, according to industry figures reported by C. G. Frantz, Cleveland, secretary of the

NEW MULTI RANGE CLIP-ON AMMETER

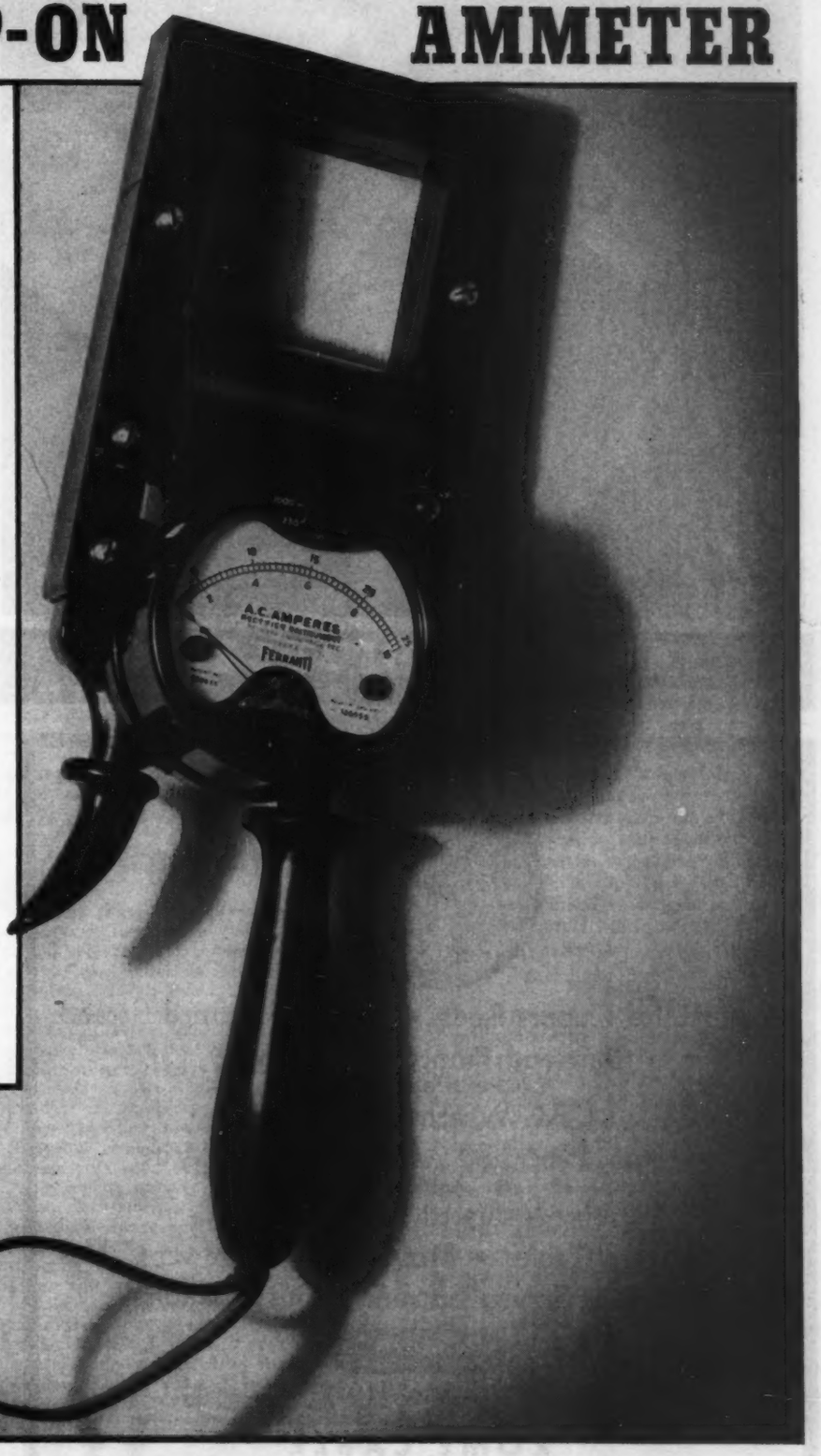
COVERING
0 to 1,000 AMPERES IN ONE SINGLE METER

•

0 — 10 amps.
0 — 25 amps.
0 — 100 amps.
0 — 250 amps.
0 — 1,000 amps.

•

Well Balanced
Light Weight
2¼" Square Opening
Bakelite Insulation
Easily Readable
Simple Scales
Complete Coverage
0 — 1,000 Amperes



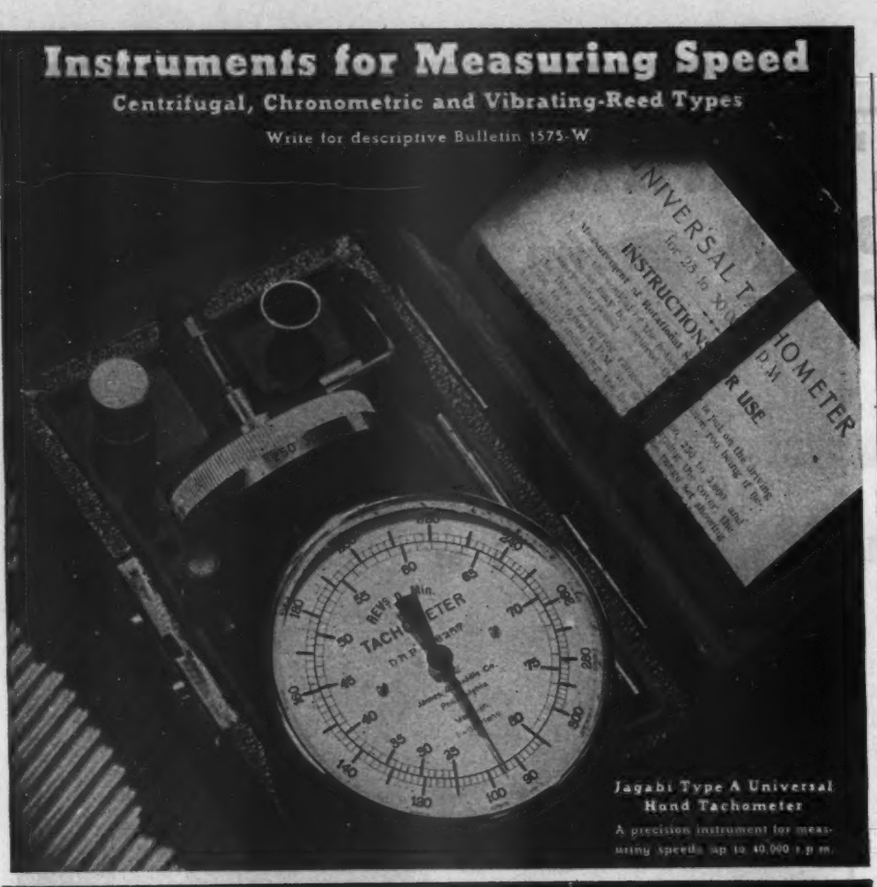
FERRANTI ELECTRIC, INC. 30 Rockefeller Plaza New York, N. Y.

Ferranti Electric, Ltd., Toronto, Canada • Ferranti, Ltd., Hollinwood, England

Instruments for Measuring Speed

Centrifugal, Chronometric and Vibrating-Reed Types

Write for descriptive Bulletin 1575-W



Jagabi Type A Universal Hand Tachometer

A precision instrument for measuring speeds up to 40,000 r.p.m.

JAMES G. BIDDLE CO.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

Hot Rolled Copper Rods • Bare and Tinned Strand

Bare and Tinned Copper Wire

(In Rounds, Flats and Squares)

URC Weatherproof Wire

Cotton, Paper and Asbestos Magnet Wire

(In Rounds, Flats and Squares)

Rubber Insulated Wires and Cords

Lead Covered Cables • Multiconductor Power Cables

Network, Service Entrance, Control Cables

ROME-60

ROME CABLE CORP. ROME, N.Y.

That New, Tough, 60% Jacketed, Heavy Duty Portable Cable

ROME CABLE

CORPORATION

ROME, N.Y.

SALES OFFICES:

New York Chicago Cleveland Pittsburgh Detroit

Boston Richmond Philadelphia Los Angeles

Vacuum Cleaner Manufacturers' Association.

Final reports for the year show sales of 1,434,419 cleaners, an increase of 9.8 per cent over the 1938 total of 1,305,873.

•

Electrical Goods Orders Increase 38% During 1939

Orders booked for electrical goods during 1939, as reported by 78 manufacturers, totaled $869,524,769, an increase of 37.8 per cent over 1938, according to Department of Commerce.

During the fourth quarter such orders amounted to $254,302,071, the largest for any quarter of the year, as compared with $212,001,139 in the third quarter and with $160,374,036 in the fourth quarter of 1938.

•

Ilg Installs Retirement Program for Employees

Announcement has been made that the Ilg Electric Ventilating Co., Chicago, has arranged for the installation of a retirement program for its employees. The plan covers more than 180 employees.

The plan, which is being administered by the Metropolitan Life Insurance Co., provides that members may retire normally at the age of 65 and receive a life income, which will be derived from monthly contributions by the employer and employees during the years of future service. The company intends to provide additional amounts of retirement income in recognition of service prior to the effective date—December 1, 1939. The monthly income thus becoming payable to employees upon retirement, plus the primary insurance benefits of the Social Security Act, will approximate from 30 to 50 per cent of pay in the majority of cases.

•

Opens New Plant

William Brand & Co., New York City, specializing in sales and service of specialized electrical insulating materials, has established its own manufacturing plant at Willimantic, Conn.

New York Metal Prices

	Feb. 6, '40 Cents per Pound	Jan. 31, '40 Cents per Pound
Copper, electrolytic	11.625*	11.625*
Lead, A. S. & R. price	5.25	5.25
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	5.89	5.89
Tin, Straits	45.25	45.875
Aluminum, 99 per cent	20.00	20.00

*Delivered Connecticut Valley.

Field Reports on Business

While the general business curve continues downward many electrical manufacturers report that the volume of incoming orders remains high. There has been no major change in utility construction budgets, although the general business picture is being watched carefully. Earnings reports make good reading.

NEW YORK

The flattening out in inventories is considered by many to be a good sign that spring buying will be a factor in the anticipated upturn. Many indexes continue to show a downward trend, some going faster than had been anticipated.

The drop in metal prices, and in some other lines, has brought out some new buying. The cut in 1940 refrigerator prices by Kelvinator has now spread to cover practically all manufacturers. Westinghouse, General Electric and Frigidaire cut last week. Kelvinator is now going after a larger share of the electric range market through an aggressive drive. Sales for the entire industry are estimated at $60,000,000 for the year.

The exceedingly cold weather, nationwide, continues to have an adverse effect on trade in many lines. Building construction has been hampered. Utilities are awaiting more favorable conditions before starting new plants. However, equipment orders are being placed in order that machinery installation schedules can be maintained. There is a lot of rural line work to be undertaken this year. Distribution expenditures for some companies occupy top rank in budgets.

From reports, the lighting industry is planning a big year saleswide. There have been sizable orders for lamps. Home building is expected to lift fixture and accessory sales.

NEMA companies see a definite improvment in business this year over last. A slight recession is seen in the first two quarters, with a sharp upturn in the second half-year.

NEW ENGLAND

Connecticut Power Co. has ordered a 25,000-kw. steam turbo-generator from General Electric for the Stamford plant. A new boiler will also be added. This utility plans to raise the voltage on the 66-kv. line connecting Hartford with the Western Massachusetts system to 110 kv. and to build a 25-mile, 110-kv. tie-line between Tariffville and Torrington, Conn. About $4,000,000 on new construction is scheduled for the system in 1940. A new 13-kv. cable line has been installed at Stamford, Conn., for increased reliability of industrial service.

Despite a slight leveling off from the trend in sales during the latter part of 1939, orders are steady and negotiations are being carried forward for a large amount of heavy electrical generating equipment. Stone & Webster Engineering Corp., Boston, reports $28,000,000 worth of new work booked for 1940. Federal contracts awarded to industries in western Massachusetts and the lower Connecticut region have forced plant expansion in many cases and pushed payrolls to new high levels.

Rockbestos Products Corp., New Haven, has received an electric cable order from the Navy Department for $12,343, Massachusetts Gas & Electric Supply Co., Boston, has been awarded a $40,355 conduit contract and the American Bosch Corp., Springfield, has contracted to supply Diesel engine accessories at a cost of $32,150.

Domestic appliance sales have now brought 45,000 electric refrigerators, 11,300 electric ranges and 2,650 water heaters to the lines of the Hartford Electric Light Co., which had 64,200 domestic customers January, 1940.

PACIFIC COAST

According to Pacific Coast wholesalers, January business receded as usual, but not so far as last year, and the input of unfilled orders is encouraging. Basic industries are healthy and are finding increasing uses for electrical equipment. Lumber mills, for example, are drawing redwood bark fibres in lengths comparable to long-fibred cotton and this defiberization, plus a heavy timber cut last year, requires substantial plant additions.

Advance reports of January building permit totals indicate a marked increase in residential and Class C construction, particularly in the Bay area. Housing projects in many stages from allotment of funds to award of contracts are supplying a building nucleus in many cities, such as Los Angeles with a $1,187,710 award for the 610-dwelling unit in the Ramona section, a low bid of $1,237,470 for the 504-unit Maranvilla section, two applications totaling $6,544,000 for 1,485 families for Ann and Utah Street sections, and approval of its application for a 1,506-family suburb costing $3,928,000. San Francisco has recently awarded $3,428,792 for two housing projects totaling 1,242 dwellings.

CHICAGO

Moving along at a slower pace, business activity, in a majority of cases, maintained substantial increases over the level a year ago. Industrial operations remain at relatively high levels, although there is an increasing tendency toward tapering off. Considerable uncertainty prevails in manufacturing circles because of the steady decline in new orders, which, unless a revival sets in soon, must result in a curtailment in production.

New building construction in Chicago showed a reduction last month from the level a year ago, permits issued declining 7 per cent in number and 23 per cent in value. Nevertheless the outlook for the immediate future appears favorable. More than $3,500,000 is being spent for construction of new factories. United Air Lines will spend $100,000 for an office building addition and a large manufacturer plans to expand facilities at a cost of $1,500,000. Exhibitors at the convention of the American Road Builders Association reported that a "buying mood" is noticeable among the engineers and road officials attending.

Electrical power output showed a slight increase over the previous week. Several sizable contracts were placed by the government for electrical equipment. R.E.A. recently awarded a $141,000 contract to a local contractor for approximately 200 miles of line construction. A manufacturer reports an order for wire and cable amounting to $215,000.

Globar
REG. U. S. PAT. OFF.

A monthly meeting place for news and views on High Temperature Electric Heat

"HOW can there be anything new in electric heat," we are sometimes asked, "when everybody knows that resistance units are already 100% efficient?" "Granted!" we say. "But not even we ourselves yet realize the extent of the potential uses for temperatures from 1400° up to 2750°F!"

Where can it be used?

The fact is, Globar Brand High-Temperature Electric Heating Elements have already won their spurs in certain definite fields. Their use in heat treating high-speed steels and in heating blanks for forging has been widely publicized. Absolute control of temperatures has made them a "natural" in the ceramic field, where so much depends on perfect firing. Same characteristics have made "Globar" ideal for annealing stainless steel wire. "Globar" is also finding wide acceptance in the chemical industry, where its use in processing tungsten, molybdenum and other oxides foretells hundreds of other uses as yet undreamed of.

What is it?

The best way we can think of to help you appreciate the possibilities of "Globar" is to tell you what "Globar" is . . . and that is a story in itself. "Globar" is a registered trade-mark owned by The Carborundum Company for non-metallic high-temperature electric heating elements, which are uncompounded recrystallized silicon carbide. They have the highest operating temperature range of any resistance elements manufactured commercially in the United States. They improve power factor to such an extent that in many cases they have paid for themselves!

More next month about what "Globar" is and what it can do. Meanwhile, if you want to jump the gun on us, you are cordially invited to write at once for more information. We'll be glad to rush it to you in double quick order!

GLOBAR DIVISION
THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.
Niagara Falls, N. Y.

[Carborundum and Globar are registered trade-marks of The Carborundum Company]

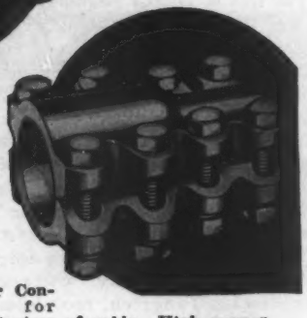
ALL Kinds of Fittings—

for every type of electrical connection. For any combination of tube, bar, cable, or wire.

More than 6,200 items.

Clamp Type Tees in all sizes. High copper alloy; machined contact surfaces.

Self-Locking Tees that hold permanently tight. With and without extension.



Reducer Connectors for different sizes of cable. High copper with Everdur bolts, nuts, lockwashers.

You will be interested in the many NEW and IMPROVED fittings in the Penn-Union Catalog. Write for it.

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JACKSON, MICH.—Consumers Power Co., Jackson, plans two new 140,000-volt transmission lines, totaling about 100 miles, extending from Lansing to Flint, close to 55 miles, and from Alma to Saginaw, approximately 45 miles, respectively. Work is scheduled to be carried out as part of 1940 expansion program.

JACKSONVILLE, FLA.—Officer in Charge of Construction, Naval Air Station, Federal Building, Jacksonville, receives bids until February 23 for electrical distribution system at naval air station, Banana River, Brevard County, Fla., including main step-down power substation, five distribution transformer stations, two miles of underground distribution lines, about one-half mile of overhead distribution system, floodlighting system, street-lighting, manholes, ducts, cables and wires, special electrical facilities, etc. (Specifications 9657).

LOUISVILLE, KY.—Reynolds Metals Co., 2934 Grand Street, manufacturer of tin, aluminum and other metal foils, plans installation of motors and controls, regulators, conveyors and other equipment in new one-story addition to plant on Camp Ground Road; also similar equipment in other new local plant unit, comprising former works of Ford Motor Co., totaling about 107,000 square feet of floor space, recently acquired, to be improved and equipped for expansion. Entire project is reported to cost over $500,000.

HUNTINGTON, W. VA.—Appalachian Electric Power Co., Roanoke, Va., plans new outdoor power substation at Eighth Avenue and Eighth Street, Huntington. Cost estimated close to $100,000 with transformers, switchgear and auxiliary equipment. Company also will build new power substation at Richlands, Va., recently noted in these columns, similarly of outdoor type, with 2000-kva. rating. Extensions will be made in 33-kv. transmission line for connection with last noted substation, with provision for three 12-kv. outgoing circuits. Another substation unit is planned at Milton, W. Va., to cost close to $45,000, and new headquarters and operating building at Williamson, W. Va., to cost approximately $175,000. Work noted will be part of 1940 expansion program.

CALMAR, IOWA—Town Council is considering new municipal electric power plant. Hubbard Engineering Co., 415 North LaSalle Street, Chicago, Ill., has been engaged to make surveys and estimates of cost.

DAYTON, OHIO—Contracting Officer, Material Division, United States Army Air Corps, Wright Field, Dayton, receives bids until February 14 for large quantities of lighting and power cable and wire (Circular 1005).

BALTIMORE, MD.—Rustless Iron & Steel Corp., 3400 East Chase Street, plans installation of motors and controls, conveyors, electric furnace and auxiliary apparatus, electric hoists and other equipment in new additions to mill. Financing in amount of about $600,000 is being arranged for project, through sale of a block of common stock. Proposed to begin work soon.

CLARKTON, N. C.—Tide Water Power Co., Wilmington, N. C., plans new 110,000-volt power substation at Clarkton, in connection with extensions in transmission and distributing lines in that area. Work scheduled to be placed under way in spring.

IRONWOOD, MICH.—City Council is considering new municipal electric power plant and will engage an engineer to make surveys and estimates of cost at early date. It is reported that project will cost in excess of $900,000. A. G. Wood, city manager, is in charge.

BONNEVILLE, ORE.—United States Engineer Office, Bonneville, receives bids until February 16 for 196-kv. disconnecting switches and bus insulators for Bonneville project (Circular 129).

SPOKANE, WASH.—Washington Water Power Co., Spokane, plans new outdoor-type power substation near city for step-down service for 110,000-volt transmission line. Cost estimated close to $125,000.

LAKE CHARLES, LA.—Continental Oil Co., Ponca City, Okla., plans installation of motors and controls, transformers and accessories, electric pumping machinery and other equipment in new gasoline refining plant in Westlake district, near Lake Charles, where site has been selected. A power house will be built. Entire project will cost in excess of $3,000,000. Work will begin early in spring. Executive offices of company are at 10 Rockefeller Plaza, New York, N. Y. Daniel Moran is president.

HOT SPRINGS, N. M.—City Council plans transmission line from Elephant Butte hydroelectric power development of federal government to city limits, for municipal power supply. Contract for such service is now being made. A power substation will be built at line terminus. Cost reported close to $50,000.

ST. CHARLES, MO.—City Council is considering report of Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., consulting engineers, covering installation of municipal power distribution system and street-lighting system in downtown area. Three proposals are included in recommendations, estimated to cost $47,310, $39,800 and $39,490, respectively.

LONG BEACH, CALIF.—City Council has authorized an appropriation of $28,000 for extensions and improvements in street-lighting system. Proposed to carry out work soon. George E. Baker is Public Service Director and City Engineer.

PORTLAND, ORE.—Administrator, Bonneville Project, Department of Interior, 811 N. E. Oregon Street, Portland, receives bids until February 19 (postponed from February 12) for seven 10,000-kva. transformers (Circular 691).

DALLAS, TEX.—International Harvester Co., 180 North Michigan Avenue, Chicago, Ill., plans installation of motors and controls, regulators, conveyors, electric hoists and other equipment in new branch plant at Dallas, for production of agricultural machinery, parts, etc. Work will proceed early in spring. Cost estimated about about $350,000.

BREMERTON, WASH.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until February 20 for four motor-generator sets, four controllers and spare parts for Puget Sound Navy Yard, Bremerton (Schedule 659).

GEORGETOWN, KY.—Kentucky Utilities Co., Cynthiana, Ky., has authorized construction of new transmission line from Georgetown to Cynthiana, close to 25 miles, and will begin work soon. Cost about $55,000.

DALLAS, TEX.—Dallas Power & Light Co. plans extensions and improvements in underground conduit system in downtown district, including installation of new lines.

Recent Allotments Made; Contracts Let

Rural Electrification Administration recently made an allotment of $25,000 for the construction of a locker type community refrigeration plant, located near Monroe, Ga.

Other allotments included $67,000 for the establishment of a distribution system in Virginia, $370,000 to the New York State Electric & Gas Co. for construction of approximately 337 miles of short extensions to the company's present system and $30,000 for miscellaneous construction and operating costs of the Lancaster County Rural Public Power District at Lincoln, Neb.

Construction contracts:

OKLAHOMA—Cotton Electric Co-operative, Walters, C. W. Cox, supt., and Midwestern Engineering & Construction Co., Tulsa, engineers, contract to the B. and M. Construction Co., Oklahoma City, another section of project, 117 miles of line, 270 members; bid $65,211.

PENNSYLVANIA—Somerset Rural Electric Co-operative, Inc., Somerset, Harvey S. Jennings, supt., and Gibbs & Hill, Inc., New York City, engineers, contract to Kingsbury-Samuel Electric Co., Baltimore, Md., another section of project, 166 miles of line, 530 members; bid $124,274.

SOUTH CAROLINA—Marion Electric Co-operative, Inc., Marion, L. T. Leitner, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to J. B. Britton, Sumter, S. C., for building project, 152 miles of line, 440 members; bid $86,884.

TEXAS—Lower Colorado River Electric Co-operative, Inc., Giddings, Lee McWilliams and Lower Colorado River Authority, Austin, engineer, contract to Ainsworth Construction Co., Dallas, first section of project, 645 miles of line, 1,302 members; bid $324,920.

WISCONSIN—Barron County Electric Co-operative, Barron, Frank Havel, supt., and Wisconsin Development Authority, Madison, engineer, contract to Commonwealth Electric Co., St. Paul, Minn., another section of project, 221 miles of line, 788 members; bid $144,988.

•

Primary Load Up 12.6%

Hydro-Electric Power Commission of Ontario reports primary load for all systems in December at 1,765,471 hp., against 1,567,239 hp. in December last year, an increase of 12.6 per cent. Primary and secondary loads for all systems totaled 2,060,184 hp., against 1,954,083 hp. last year, an increase of 5.4 per cent.

•

Jersey Rate Hearings End

Hearings in the Jersey Central Power & Light Co. electric rate case have been recently concluded by the state Public Utilities Commission and the proceedings went to board conference for decision. Counsel and other interested parties were given until February 20 to file briefs.

•

Bills Introduced in N. Y. Legislature

Several bills have been introduced in the New York State Legislature affecting the electric light and power industry. Among the measures introduced during the month of January are the following:

An act was introduced in the Assembly to amend the labor law in relation to providing for the safety and protection of employees engaged in the construction, repair and inspection of certain high-voltage electric lines. The measure was referred to the committee on labor and industries. A companion bill was introduced in the Senate. Another measure was introduced in both the Assembly and the Senate amending the labor law in relation to providing for the safety and protection of employees engaged in electrical work at certain substations, power houses, rectifier stations, transformer stations, shops and buildings.

Under the terms of a bill introduced in both houses the sub-metering provisions of the public service law were amended by inserting a new subdivision to the effect that "the term 'electric sub-metering corporation' when used in this chapter shall include every corporation, company, association, joint stock association, partnership and person, their lessees, trustees or receivers, appointed by any court whatsoever, who or which is not an electric corporation, but who or which as principal or as agent distributes and sells electricity generated by himself or another; the term, however, shall not include a corporation generating or distributing electricity solely on or through private property for railroad or street railroad purposes or for its own use or such a person or corporation who or which distributes and sells electricity solely generated by the seller and having no contract with any electric corporation for electric service, and distributed by such producer solely on or through private property for sale to his own tenants and not for sale to others." The new bill provides that "no gas or electric sub-metering corporation shall directly or indirectly demand, charge, receive or collect a rate of charge which shall exceed the rate or charge in the rate schedule of a gas or electric utility operating in the same territory for the furnishing of a like and contemporaneous service under the same or substantially similar circumstances or conditions." The public service commission shall have general supervision over electric sub-metering corporations and gas sub-metering corporations.

A bill has been introduced in the Assembly and referred to the committee on public service amending the public service law in relation to determination of the rate of electricity and gas for certain consumers. Under its terms on or before October 1, 1940, and in each year thereafter all gas and electric corporations whose schedules on file include optional rates for consumers shall give to each of its respective consumers who is entitled to such optional rate or charge a written notice setting forth the lowest rate or form of rate available in such filed schedules for the class and quantity of service rendered.

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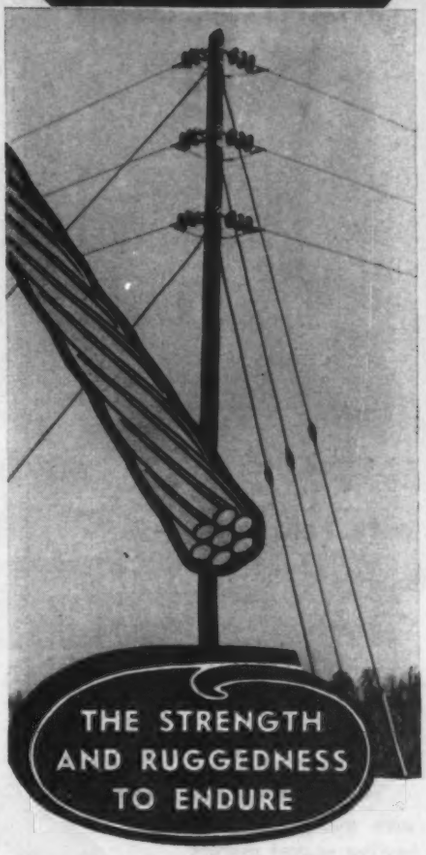

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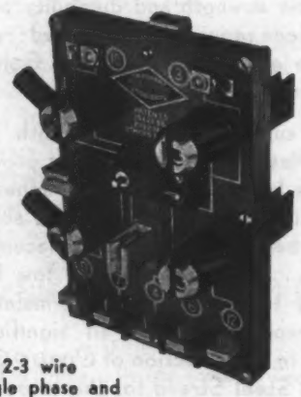

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Why Right Now?

[*Continued from page 66*]

so it goes with other replacements in the "anti" list.

But besides this there is weakness on the pro side. Senator Costigan, Colorado, voted for ratification in 1934. Senator Johnson, who succeeded him, has come out against the seaway on the ground that it would be a hardship on the railroads. Senator Smith, South Carolina, may feel very differently when the roll is called again. He was an ardent supporter of the Administration in 1934. The "purge" and other things have happened since.

Senator Brown, New Hampshire, another "pro" vote, has been replaced by a Republican, C. W. Tobey, more interested in Portsmouth not being hurt as a port than in whether Mr. Roosevelt achieves his St. Lawrence power dream.

In fact, it is an even money bet that if and when a St. Lawrence Seaway treaty reaches the present Senate it will not only fail to obtain the two-thirds majority necessary to ratification but that it will be beaten by a majority vote!

Which would seem to give considerable point to May Craig's question to Mr. Roosevelt!

•

La Tuque Unit Progresses

At the annual meeting of the St. Maurice Power Corp., held recently, such satisfactory progress was reported in the 162,000-hp. hydro-electric development presently under way at La Tuque that it is now expected this plant will come into commercial operation within eleven months, and possibly by October 1 next, when three units, each of 40,500 hp. capacity, will be in production.

•

League to Change Name

At a recent meeting of the directors of the Electrical League of the Niagara Frontier, Buffalo, N. Y., it was decided to change the name of the organization to the Electric Association of the Niagara Frontier, Inc. A special committee, composed of George H. Calkins, chairman; Karr Parker and M. E. Skinner, is charged with the responsibility of having a revised constitution and by-laws drawn up and taking the necessary steps incident to incorporating.

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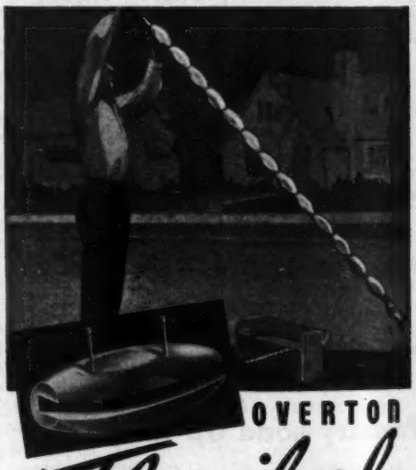

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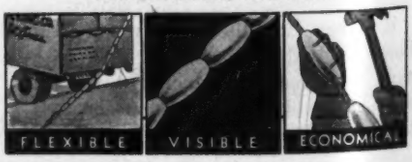

A.I.E.E. Sessions Explore Current Problems

[*Continued from page* 53]

The Measurement of Spot-Welding Current—By W. F. Hess, R. A. Wyant, A. Muller (all Rensselaer Polytechnic Institute).

Measurement complicated by brief (1/10 second) duration of welding current and variable transients from non-synchronous closure of welding circuit. Paper reports studies on oscillograph, current crest meter, pointer-stop ammeter, vacuum-tube voltmeter and neon tube meter methods with their respective advantages and limitations.

Guide to Good Electrical Performance of Resistance Welding Machines—Subcommittee on Power Supply for Welding Operation.

First of three reports on electric service for resistance welders, this sets up criteria for electrical characteristics (demand, p.f., heating), power supply requirement, transformer, control equipment and nameplate ratings.

Fruits of the joint committee's efforts to compose and converge the interests of welding users, manufacturers and utilities were shown by the fine co-operative spirit of this session. The two committee reports are to be followed by a third which will afford a guide to good factory wiring for large resistance welders. S. M. Humphrey (Warren, Ohio) stated that manufacturers are prepared to aid users and utilities with duty cycle information that also allows margins for contingencies. J. W. Anderson said the Philadelphia problem was the small welder at unforeseen points on the distribution system, but L. W. Clark (Detroit Edison) has most concern about welders of large capacity and duty. The company has a rate involving payment for rental and installation cost of supply facilities required to prevent harm to service quality for other customers. He cited one case where a 700-kva. limitation was exceeded up to 1,500 kva. merely because a control tube was not functioning.

H. E. Wulfing said the Chicago company was devising a rate and would have been greatly aided had the committee reports been available sooner.

Series capacitors are, like shunt units, finding added favor for corrective purposes, said J. W. Butler (General Electric). Both applications afford equal corrective potentiality for equal capacitances. He cited an effective installation of series capacitor on a graphitizing furnace load where

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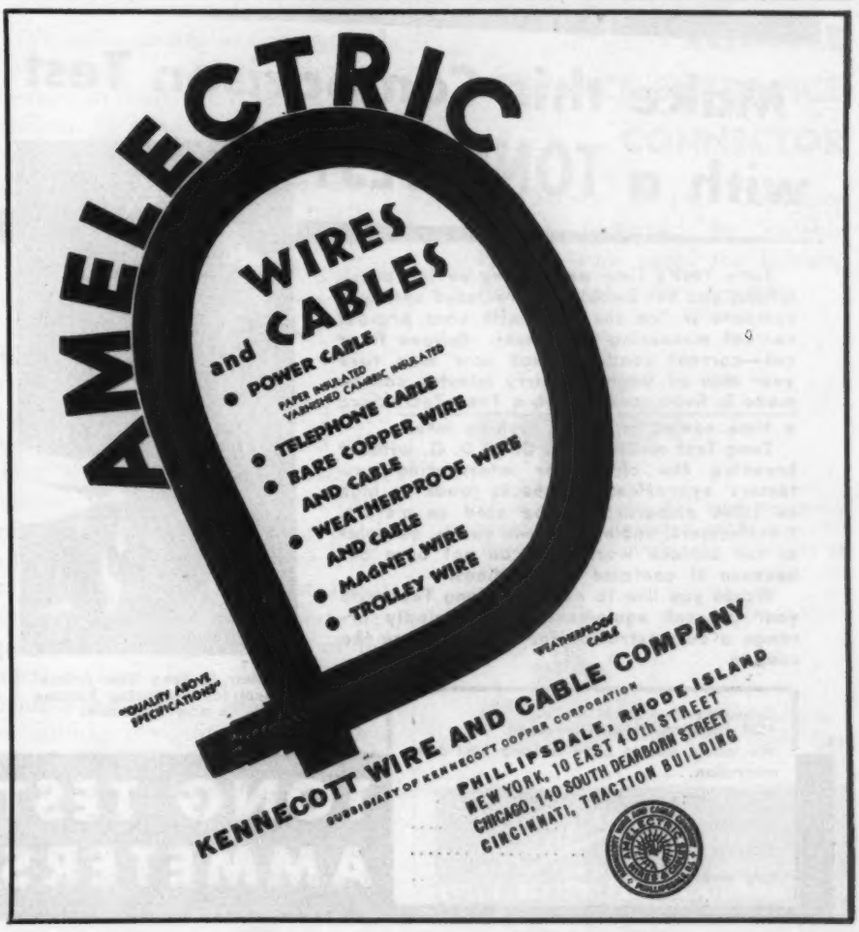

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its ohms were made equal to the reactance ohms of the bus and furnace to give continuous correction to unity power factor. L. G. Levoy mentioned that capacitors now cost 35 per cent what they did ten years ago, a large factor in increasing the scope of their usefulness in compensating for deleterious voltage and power factor loadings.

Railroad Electrification Economics

Railway Power Supply—By **Philip Torchio** (Consolidated Edison, retired).

Analyzes the alternative contractual relations and the bearing upon them of load factor, demands, rate of growth and the hesitant status of electrification. Obstacles other than power cost deter electrification. Utilities have demonstrated that railways can buy energy more cheaply than they can make it. However, under prevailing prices for coal, electrification has demonstrated its superiority only where "consideration unrelated to operating costs," heavy traffic or high speed have dictated it. If only one-third the unelectrified railroads should electrify the consumption would equal present residential use.

Power Supply for Railroad Electrification and Fundamentals of Power Contracts—By **E. R. Hill** (Gibbs & Hill, Inc.).

Electrified trackage only 1.3 per cent here, 6 per cent elsewhere. Enumerates the recognized advantages. Load factor 62 per cent for composite suburban, through freight and passenger service and as high as 75 per cent with suburban peaks out. Joint billing of joint demands by several interconnected utilities mutually advantageous. Suggests that spurt to electrification might result from opportunity to obtain roadway power equipment under equipment trust plan already functioning on conventional rolling stock. Reduced power rates and reduced capital cost of electrification would make pending projects attractive and load potentially available to utilities.

Commenting on the Hill paper, N. E. Funk (Philadelphia Electric) took some exception to the implication in the paper that the railroads have not shared in the general reductions of rates that have benefited other classes of electric utility customers. Although this may appear to be the case in simple consideration of prices for energy, it must not be forgotten that the railroads have received the equivalent of large rate reductions through another avenue. He referred to the cost of coal delivered at the power plant, which, in one case at least and probably in many others, now contains a freight charge larger than the combined cost

of coal and freight a few years ago.

D. R. MacLeod (General Electric) pointed out that a steam locomotive —according to quoted figures—uses 4 lb. of coal to do the same work as an electric locomotive does with 1 kw.-hr. On the basis of good average performance of a modern electric station and from the standpoint of conservation of the national fuel supply, it appears that electrification would save 75 per cent of the coal now consumed by the railroads. The most obvious method of approach to general railroad electrification, said Mr. MacLeod, is for the power companies "to work with the railroads in an effort to fit the railroad load cycle into their industrial and domestic load cycles so as to improve their system load factor" and for the railroads to study their own operations to the same end.

Between the one extreme of lowest cost to the electric utility by railroad ownership and operation of high-voltage transmission lines along the whole transportation system and of highest cost by delivery of energy at numerous points along the way lies somewhere the system of supply in which, by the co-ordinated design of the railway and utility facilities, a minimum over-all cost is obtained. This statement of the range of electrification cost was made by E. L. Harder (Westinghouse), who said further that it is "certainly to the interest of all concerned to determine the over-all arrangement of power supply facilities that will result in the minimum cost." In line with the discussion by Mr. Harder was the suggestion from F. A. Allner (Pennsylvania Water & Power) that much might be saved by joint construction of railroad power supply and electric system facilities.

H. F. Brown (N.Y., N.H. & H.R.R.) rather disturbed the reasoning of the Hill and Torchio papers by stating rather definitely that in the larger analysis power cost is not an important consideration in the problem of railroad electrification. He instanced the 50,000,000 hp. of electric utility capacity, the 100,000,000 of railway power and the 1,000,000,000 hp. in automotive vehicles in this country. And it is certainly true that the 1,000,000,000 hp. in automobiles is far from power at low cost. Therefore, concluded Mr. Brown, if railroad electrification can be made attractive to the public, like streamlined trains and air conditioning of cars, the cost of power for it will become a minor item.

Transportation Technology

Unsolved Problems of Electrical Engineering in the Field of Transportation—By **J. A. Noertker** (Cincinnati Street Railway).

Stimulating résumé of research and development needs. Cites lack of co-ordination of power supply systems with transport power systems. Lower cost catenary needed. Standard national traction system, urged by Sidney Withington in 1931, still a desideratum. Elimination of control resistor losses and infinite acceleration steps. Efficient d.c. voltage conversion. Better batteries. Thermostatic control for multiple-unit cars.

Trends in Railroad Motive Power—By **Sidney Withington** (New York, New Haven & Hartford R.R.).

Comprehensive review of change in service requirements and the adoption of non-electrical motive equipment for contrast with electrical motive power evolution to provide quicker and smoother acceleration, faster running and more margin of power for air conditioning, etc. Trend is toward more power concentration per locomotive unit with interchangeability for freight and passenger service (peaks non-coincident).

Discussion in this section centered mostly on the Noertker paper because it raised so many and diverse considerations. In spite of the apparently generally accepted idea that direct current or low-frequency alternating current was necessary for traction power, G. M. Woods (Westinghouse) opined that commercial frequency should be suitable. This was contested by N. Litchfield (Gibbs & Hill), citing the present investment in special equipment. Another angle was raised by H. F. Brown (N.Y., N.H.&H.R.R.), who intimated that since it was the requirements of lighting that fixed the present commercial frequency when the possibilities of railroad loads were small, it might in justice be suggested that lighting be adapted to lower frequency now that possibilities of the traction load loom larger. More thought and research should be given to railroad electrification problems, said J. W. McNairy (General Electric), and E. W. Brandenstein (General Electric) asserted that what was needed was a long line electrification of a thousand miles or more to establish the advantages of electrifica-

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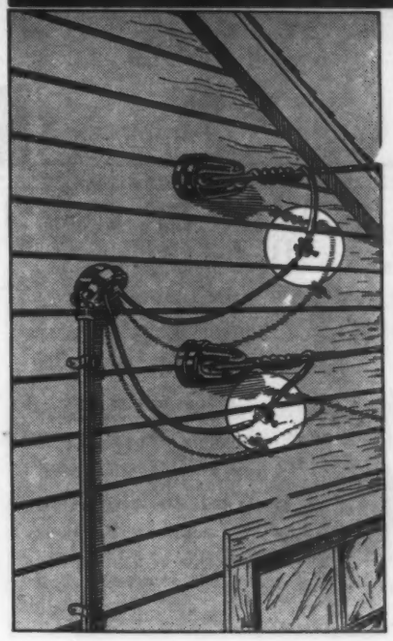

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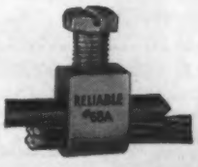

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Electron Tubes and Electric Wave Filters
Miscellaneous Electrical Applications

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tion incontestably and as well to reduce to definite terms the problems of the job and remove them from speculative statements and solutions. Sidney Withington (N.Y.,N.H. &H.R.R.) realistically emphasized that standardization on some system of power supply was a need more urgent than the exact determination of the very best one.

J. C. McCune (Westinghouse Air Brake) was of the opinion that Messrs. Craton and Turner were a mite too optimistic about the possibilities of regenerative braking in their paper. He pointed out that braking depends on rail adhesion and that a locomotive with power to pull a train up-hill empty might not be big enough electrically to hold the train on the down-hill grade with the cars loaded. In this observation he referred particularly to trains bringing out ores from mountain mines. W. J. Clardy (Westinghouse) thought that the use of energy from electric braking for car heating was a field that might be explored further with profit.

Electronic Developments

"Excitron Mercury-Arc Rectifiers—By O. K. Marti (Allis-Chalmers).

Concludes that single-anode rectifier with continuous excitation can be just as reliable and free from backfires as with intermittent ignition. Low arc drop, small tanks (with sensitive high-speed cooling system) and no occason to fear undue overloading of transformer secondary windings.

Discussion was confined almost exclusively to Marti's paper, with a number of Westinghouse engineers disagreeing with the paper. G. F. Jones pointed out that "ignitron" has been in commercial operation for three years, questioned accuracy of Marti's arc drop values and added that "excitron" excitation system is complicated with many moving parts requiring maintenance. He cited figures showing that of 40 rectifiers, totaling 140,000 kw., purchased during 1939, 36 were ignitrons, totaling in excess of 130,000 kw. Mr. Jones said that Marti's diagram for ignitron ignition had been obsolete for many years.

J. H. Cox also questioned arc drop values, disagreed that ignitors are delicate and require highly accurate immersion, saying it may vary as much as one-quarter inch, in normal

service, even during extreme overloads. Professor Northrop (Cornell) suggested that a study of baffling might be the answer to the arc-back question. In answer to the question of accuracy of his curves, Marti invited critics to bring their own instruments to Milwaukee and check the results for themselves.

Industrial Power Applications

Dynamo-electric Amplifier for Power Control—By **E. F. W. Alexanderson, M. A. Edwards, K. K. Bowman** (all General Electric).

Amplidyne is two-stage amplifier incorporated in one dynamo-electric machine characterized by a pair of short-circuited brushes at right angles to power brushes. Amplification ratio of 10,000 to 1 realizable as product of 100/1 between input winding and short-circuit axis and another 100/1 between the latter and the output axis. Adjustment of back-coupling neutralization critical, but stable operation is attainable. Minute energy in beam of light can control many horsepower quickly and precisely through medium of amplidyne.

The Design Characteristics of Amplidyne Generators—By **Alec Fisher** (General Electric).

Low reactance armature. Complete compensation of armature reaction. Reduced transient losses from commutation currents and variable brush contact drops. Small air gaps. Low magnetic densities make size larger than for conventional ratings.

Industrial Applications of Amplidyne Generators—By **D. R. Shoults, M. A. Edwards, F. E. Crever** (all General Electric).

A "closed cycle" controller, the amplidyne is applicable to machine tool positioning, strip reels and polishers, single-motor paper-machine drive, flying shears and other applications requiring prompt and precise response to control.

The three amplidyne papers, dealing with the theory, design and application of a single machine, naturally were discussed together and, also naturally, a principal part of the discussion consisted in comparison of the amplidyne with devices already available for similar control functions. C. R. Hanna (Westinghouse) instanced in comparison the simple exciter generator with an electromechanical rheostatic voltage regulator such as the Silverstat or the like. He pointed out that such an assembly under certain conditions might give a control amplification of 200,000, as against the amplidyne's 10,000. Also, he commented on the simpler problems of manufacture and operation of control devices using the mechanical reference of a spring, as against the electrical reference current employed in the amplidyne.

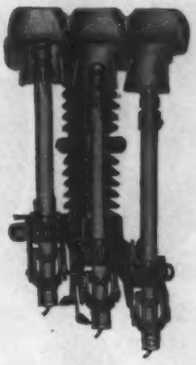
K. M. Sparrow and E. C. Watson (Westinghouse) raised numerous questions as to the theory and operation of the amplidyne in reference to stability, to frequency variation, to brush contact drops, to electromechanical resonance with controlled equipments, to effect of residual voltage on accuracy of response and to the types of circuits in which the amplidyne may be used. A. J. Williams (Leeds & Northrup) asked if two amplidynes could be coupled together for higher amplification, and Dr. Alexanderson replied that this could be done. G. S. Brown (M.I.T.) suggested that the amplidyne might be compared to the negative feed-back amplifier, so well known in radio.

R. W. Porter (General Electric) stated that an ordinary generator requires about one per cent of its rated output for excitation and that the amplidyne needs only about one-hundredth as much and therefore must dissipate only that fraction of energy in heat as against an ordinary generator employed in the same arrangement and function. K. K. Bowman (General Electric) pointed out that the volt-ampere input to the control field of the amplidyne tended to remain constant regardless of the size of the machine. This means, he said, that one size of control apparatus, such as a high-vacuum tube amplifier, might be standardized to control loads from a few watts to many kilowatts. Heretofore, said P. L. Alger (General Electric), high amplification of signal control had been regarded as almost an exclusive property of the electrical communication art. Now the amplidyne brings the same ability of control into the power field. He regarded the amplidyne as an extremely significant development in bringing together the technical facilities and resources of the two fields.

•

Moves Chicago Offices

Phelps Dodge Copper Products Corp. has announced that on and after February 1 the Chicago office will be located at 140 South Dearborn Street, Marquette Building.



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Nut Housing locks EVERSTICK firmly on rod.
POWER TO HOLD

Glass Tube Rectifier for Shop D.C. Supply

[*Continued from page 54*]

drooping or shunt characteristic with a voltage increase from full load to about 1 per cent load of about 6 per cent.

Six-phase a.c. supply to the rectifier is provided by a separate rectifier transformer in the same outdoor substation with plant a.c. power transformers. This 360-kva. transformer steps service voltage of 4,150 volts, three-phase, 60 cycles down to 235 volts, six-phase, 60 cycles for application to the rectifiers. The transformer is an oil-insulated, self-cooled, outdoor type having features and accessories standard for corresponding size and type distribution transformers. The three-phase primary winding is delta-connected and the secondary is connected double wye to give six phase. The neutral points of the two wyes are connected to the built-in interphase transformer, the midpoint of the wye of which is brought through to the d.c. side where it is the negative conductor.

As shown in the accompanying diagram, the six-phase secondary voltage is brought in to the building through an air circuit breaker to a six-phase bus, from which taps lead to the six anode arms of each rectifier tube. The four tubes operate in parallel, having positive leads from the mercury pool cathodes brought out to individual single-pole, single-throw knife switches, which are solidly connected to the positive side of the outgoing d.c. bus. The negative side of the d.c. bus originates in the common neutral of the interphase transformer secondary and is brought out through a knife switch. With this switch closed and excitation applied, any of four cubicles or tubes can be thrown on the line by merely closing the corresponding knife switches. Each cubicle is fused separately on the six-phase a.c. bus.

Operation Simple

To put the rectifier unit in operation close the auxiliary breaker, which will start the ventilating fans and actuate the ignition devices of each rectifier tube. These devices will energize the ignition magnets, causing them to dip their ignition anodes into the mercury cathodes. This, in turn, operates the ignition relays, causing the ignition magnet circuits to be interrupted and permitting the ignition anodes to snap back by spring action and striking their arcs. The resulting ionization will establish the arcs to the excitation anodes, which are maintained over small artificial loads, and thus make each rectifier tube ready for service. The closing of the six-pole air circuit breaker puts the rectifier unit on load. A main knife switch is provided in the negative lead to isolate the complete unit from the d.c. bus and auxiliary switches are available to sectionalize each individual rectifier cubicle.

Each rectifier is air-cooled by a forced draft from an individual fan located in the cubicle below the tube. This fan is interlocked with the excitation control and permits the rectifier tube to operate at a maximum ambient temperature of 40 deg. C. (104 deg. F.)

Wave Shapes of Successive Lightning Current Peaks

[*Continued from page 58*]

being prepared to the earth as a space charge. As the leader approaches the earth the positive charges in the earth directly beneath become more concentrated, with the result that the stress is often high enough to cause the formation of pre-stroke streamers from the surface of the earth. Such streamers have been photographed.

The height of these earth streamers adds to the physical height of srtuctures or objects on the earth's surface, and probably often determines which object will be struck, providing other factors are equal.

If a transmission line ground wire is to be struck, as an illustration, positive earth charges move rapidly to the point which is going to be struck, and these constitute a current and represent the wave front of the stroke. The rate at which the leader streamer and the charges associated with it approach the earth will determine in a large measure the rate and number of positive charges moving to the point to be struck. Thus the shape of the front of the wave measured on the transmission line will be determined largely by the propagation velocity and amount of charge in the down-coming leader.

The crest value of current is probably reached when the leader makes contact with the earth, or the stream-

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er from the earth, or contacts the transmission ground wire in the case under discussion. The positive charges from the earth continue to move up into the channel prepared by the leader. The time taken for the so-called return stroke to reach the cloud or the end of its travel is the length of the tail. If it reaches the cloud and current continues to flow, it will, except for current pulses or peaks, continue at a relatively small magnitude of current on account of the construction of the cloud. Current flowing in the cloud requires a progressive breakdown action rather than conduction, as occurs in the earth where conductors are involved.

Shape Not Accidental

Thus we arrive at the conclusion that the wave shape of direct strokes of lightning on conductors on the earth's surface is not an accident, but is determined by cloud charge, by rate of propagation of leader strokes, the amount of space charge around the channel and the charge in the tip of the leader itself. The availability of charge on the earth's surface at the point struck will have much to do with the magnitude of the current for a given cloud condition. Thus, it would be expected that lightning striking a conductor connected to an extensive grounding system many miles in extent would have a higher current magnitude and shorter duration than a stroke to a mountain whose rock is a non-conductor, or to a wide expanse of deep sand whose conductivity is very poor.

The phenomena of lightning, therefore, and its effects may have been considerably influenced by the structures on the earth's surface built by man, and in studying lightning in different localities these effects need to be given consideration.

•

Adequate Wiring Program Organized in Muskegon

More than 40 members of the electrical industry in Greater Muskegon, Mich., including full representation of electrical contractors, held an organization meeting recently preliminary to the formation of an adequate wiring program.

Stanley Johnson, Consumers Power Co., was named temporary chairman of the committee. He will also serve as field man in the wiring activity.

At left — split tinned cable sleeves. Center—The Figure Eight, seamless. Below — the Seamless Oval.

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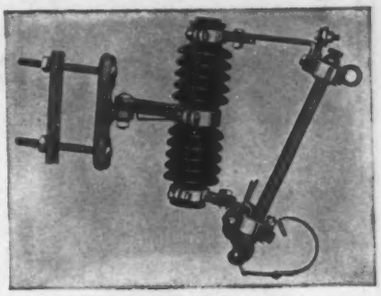

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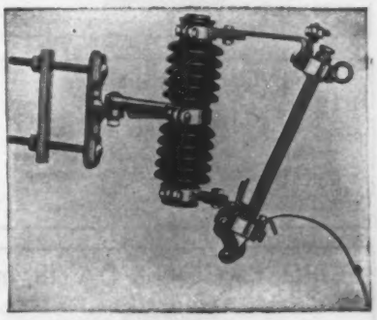

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Ranges and Water Heaters Boost Use to 1,985 Kw.-Hr.

[*Continued from page 62*]

exposing the customer to at least two contacts by the dealer on his own sales floor.

Cooking schools were conducted throughout the system, and here again the low cost of electric cooking was emphasized with complete meals metered as they were prepared on the platform and the cost computed before the audience.

Kitchen planning likewise was made an integral part of the promotion. This work was carried on through a Better Housing Committee, a subdivision of the Spokane Chamber of Commerce, under the name of the Modern Kitchen Bureau. This bureau was financed by housing interests and employed a full-time director or planning consultant, maintained a model all-electric kitchen for public demonstration and offered planned kitchen sketches embodying electric cooking, water heating and refrigeration to the prospective modernizer. All sketches were individually planned to fit the needs of the prospect.

To encourage dealer interest in the sale and promotion of electric water heaters as companionate to electric cooking a plan of installation was offered. Storage type water heaters which qualified to operate on the company's off-peak 8-mill water heating rate and were sold to residential customers of the company were completely installed, including wiring and plumbing, by the company for the dealer at a standard $10 figure. The company under this plan of installation reserved the right to refuse installation if the water heater, in the company's judgment, did not meet the needs of the customer's home.

Having thus established dealer interest in the sale of water-heating equipment, along with the electric range as an added source of profit, the plan of installation after two years' use was discontinued with the end of 1938.

To stimulate added interest in the promotion on the part of company salesmen a special bonus of 10 cents for each dollar of the new E.A.R. sold where no capital investment was required was offered. E.A.R. was computed on the basis of $28 for an electric range sold to a new customer and $36 for an electric water heater sold to a new customer. Payment of this extra cash bonus was contingent upon the making of quota. While dealer sales counted toward E.A.R. town quotas, they were not eligible for this bonus.

The element of competition among divisions was introduced with the offering of a "Reddy Kilowatt" trophy in neon standing 4 ft. high to the division with the highest percentage of quota reached during each sales period, the trophy becoming the permanent property of the division with the highest percentage of quota for the three-period program. Fun was introduced with the awarding of an animated jackass to the laggard division for each period. Weekly sales progress reports and letters built around the trophy and jackass kept interest keen.

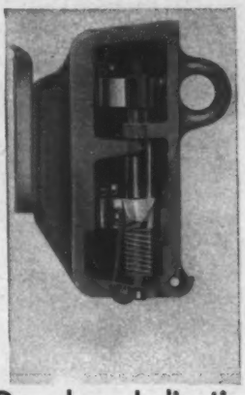
Mobile Transformer Unit Lessens Interruptions

[*Continued from page 63*]

ber for supporting the heavy primary leads at the cutout. Both cutouts are mounted on the top member so that they can be operated safely from the ground. From the cutouts the primary leads are trained down to the lower horizontal member and supported on steel bolt pins with low-voltage insulators. The position of this member is determined by the height of the bushings on the transformer. It should be located to permit training and connecting the leads to the transformer.

Three No. 4 600-volt, rubber-insulated flexible copper cables, approximately 50 ft. long, are used for the secondary leads. These leads are supported at the truck on an insulated spool clevis attached to the top of the body rack with a $\frac{5}{8}$-in. machine bolt. The 4-in. clevis pin has been replaced with a $\frac{5}{8}$ x 12-in. through-bolt so that three rack spool insulators can be mounted on a single clevis. The leads are taped together and when in use are connected to the secondary lines with solderless connectors.

Every precaution has been taken to make the installation safe while in service. Danger signs are posted on both sides of the truck and a lamp is connected in the secondary circuit which remains lighted while the transformer is energized.



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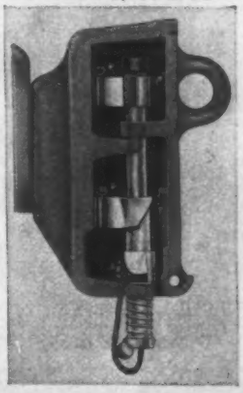

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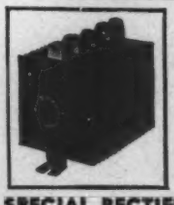

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Recent Rate Changes

KEYSTONE PUBLIC SERVICE Co. has agreed to reduce rates in the amount of $120,800 a year, effective in all billings resulting from meter readings after February 15, according to an announcement by the Pennsylvania Public Utility Commission. The commission stated that in view of the reduction it had terminated its rate case against the company, but had directed the company to file a copy of its monthly operating report in order that the commission may determine the effect of the reduction.

VIRGINIA ELECTRIC & POWER Co. customers in fourteen northeastern North Carolina counties will save more than $36,000 yearly by rate reductions approved by Utilities Commissioner Stanley Winbourne at Raleigh. The rates are the same as those charged by the company in Virginia, Commissioner Winborne said. Under the new schedule the first 50 kw.-hr. used in residences will cost 5 cents a kilowatt-hour, while the present rate is 5½ cents a kilowatt-hour for the first 60 kw.-hr. The commercial rate was cut from 5½ cents to 5 cents for the first 250 kw.-hr. A new rate of 1 cent a kilowatt-hour will apply to power used for water heating. Mr. Winbourne estimated that residential users would save $19,600 yearly, commercial customers $13,092 and customers heating water electrically $4,000.

POTOMAC ELECTRIC POWER Co., Washington, D. C., has submitted a new rate schedule to the Public Utility Commission of the District of Columbia. The new schedule offers rate reductions to commercial consumers only. The utility company offered the reduction under protest and described it as "unreasonable and undesirable." The new rate schedule gives effect to a reduction in rates in the amount determined by the Public Utilities Commission to be available for such reductions. This amount, the commission stated, is $575,029. The company at recent hearings submitted a figure of $454,766. H. A. Brooks, vice-president and commercial manager of the company, presented the new schedule. He defended the application of the reduction to commercial users only on the grounds that "there is no difference in use of power between residential and commercial customers to justify the present higher rates to the latter." The commission has turned the new schedule over to its accountants for consideration.

NEW YORK STATE ELECTRIC & GAS CORP. has filed a revision of electric rates with the state Public Service Commission which has been permitted to go into effect February 5 in the city of Elmira, the villages of Elmira Heights, Horseheads, Millport, Wellsburg, Burdett, Montour Falls, Odessa, Lodi and surrounding towns in Chemung, Schuyler and Seneca counties. The change combines two general service rates and two primary power rates with the result of making a saving of $8,970 annually to customers served under the rates. No consumers will be increased.

SOUTHERN CALIFORNIA EDISON Co. will put into effect on March 1 rate reductions of approximately $1,000,000 a year. The reductions will apply to domestic, commercial and street-lighting services. The California Railroad Commission announced the rate cut comes as a result of negotiations between the board and the utility.

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(See also "Selling Opportunities Offered")

MECHANICAL ENGINEER, familiar with economies of power generation in industrial plants and with power plant designing. State education, experience and references. Location, New England. Fine position for person with required qualifications. Apply P-712, Electrical World, 330 W. 42nd St., New York, N. Y.

HAVE PERMANENT OPENING for technically trained transmission and distribution superintendent between the ages of thirty-eight and forty. Must be capable of handling men and producing satisfactory results. Address P-714, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 30 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN. Contact employers for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director, The National Business Bourse, 20 West Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunities Wanted")

POSITION WANTED: General plant engineering experience. Valuation plants and equipment, fixed capital records, inventories, reclamation. Supervision, office and field, job planning, maintenance, installation, construction. Single, any location. PW-707, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER, technical training and executive ability, 17 years active experience, public utility electrical construction and operation. Seeking assignment in Southern States. Qualification record on request. PW-700, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

TIMEKEEPER—Outside accountant, six years experience on electrical transmission, distribution system and substation construction accounting for time, materials, expense, cost distribution; preparing progress, completion, truck, safety and accident records and report, conduct safety meetings. Desires permanent connection with large contracting or utility company. References. PW-699, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER, 15 years experience covering all phases of design, construction, and operation of generating plants and substations including supervising coordination of all engineering involved in major construction projects. PW-718, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL MOTOR REPAIR Shop Foreman seeks connection with firm interested in efficient economical production. Twenty years experience. A-1 references. PW-721, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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